

**Final Report - Combined Heat and Power
Stakeholder Engagement Process:
Options, Outcomes, and Recommendations**

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Prepared by:
Michael Burr and Peter Douglass
Microgrid Institute
17501 Ginger Rd.
Little Falls, MN 56345
(320) 632-5342 / mtburr@microgridinstitute.org
<http://www.microgridinstitute.org>

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Executive Summary

A. CHP and Minnesota's Energy Goals:

Among the many options available to help improve Minnesota's energy economy, combined heat and power (CHP)¹ provides a unique set of attributes. It also presents a unique set of challenges.

CHP is an energy saving technology, providing electricity and useful heat at higher efficiencies than separate electricity and thermal generation systems. It is a form of distributed generation (DG), which reduces transmission system energy losses. Consequently, CHP produces more useful energy per unit of fuel consumed – and therefore per unit of pollution emitted. CHP also can serve to strengthen customer energy resilience and local utility networks. While variable sources of clean energy like wind or solar can be dispatched only when the wind blows or the sun shines, customers can rely on high-efficiency CHP to produce energy whenever it is needed. Like other systems that use boilers, turbines, and engines, CHP can serve a variety of customer energy needs, and can consume practically any fossil or biomass fuel.

For all these reasons, CHP offers promise as a technology solution to help the State pursue its priority objectives. At the same time, however, numerous factors limit CHP's deployment in Minnesota.

To examine the benefits and challenges of CHP, the Minnesota Department of Commerce, Division of Energy Resources (Commerce) commissioned two studies exploring CHP potential and policy options in 2014. Subsequently, Commerce initiated a stakeholder engagement process, with the goals of providing information, facilitating discussion, and informing development of a CHP Action Plan for Minnesota. This report synthesizes information gathered during this process, and recommends a series of steps for consideration in the Minnesota CHP Action Plan.

B. Stakeholder Engagement Process and Outcomes:

Commerce contracted Microgrid Institute to help lead the stakeholder engagement process, including facilitating four stakeholder meetings, synthesizing and reporting results from a public comment period, and performing pre- and post-engagement stakeholder surveys. With guidance from Commerce, Microgrid Institute designed the process to inform and facilitate discussion among stakeholders, and to synthesize information toward development of the CHP Action Plan.

¹ Combined heat and power, also known as cogeneration and waste heat-to-power, captures two or more energy products from a given generation process. A typical CHP facility might burn natural gas to simultaneously generate electricity and heat for secondary uses.

The process, which began in August 2014, yielded a wealth of useful information and perspectives from a broad cross-section of stakeholders in the Minnesota CHP market, from utility companies to commercial energy users.

Microgrid Institute compiled information and outcomes from each phase of the stakeholder engagement process and synthesized them in a series of reports. These resources served to further inform stakeholders, facilitate continued engagement, and support the planning process. As a general matter, stakeholders most consistently expressed support for:

- Development of information resources and tools for assessing and exploiting potential CHP opportunities;
- Clearer policy direction in the context of Minnesota's energy strategy and priorities; and
- Policy approaches that facilitate cost-effective CHP deployment and preserve effective and successful programs encouraging energy conservation.

C. Microgrid Institute Recommendations:

Based on its analysis of information gathered through the CHP stakeholder engagement process, Microgrid Institute developed a series of recommendations for consideration in Minnesota's CHP Action Plan. These recommendations are summarized as follows:

- i. Policy vision and strategic goals:
 - *Strategic vision:* Establish a clear set of goals for CHP in Minnesota, in the context of the State's emerging energy future plans, as well as its economic, environmental, and security goals.
- ii. Studies, research, and information resource development:
 - *CHP evaluation methodologies and criteria:* Establish standard approaches for assessing, measuring, and valuing CHP project attributes.
 - *CHP potential studies:* Perform studies to characterize and identify CHP development opportunities.
 - *Training and education resources:* Strengthen training and education resources and provide ongoing technical support for CHP project evaluation, feasibility study, and development.
- iii. CHP policy development:
 - a. *Utility standby service pricing:* Amend the State's standby rate policies to ensure fairness, efficiency, and transparency.
 - b. *Avoided-cost calculation:* Examine utility avoided-cost calculation methodologies and propose policy changes as needed to ensure avoided costs are established in ways that are accurate, fair, and consistent with the State's CHP goals.
 - c. *Least-cost utility planning:* Amend least-cost planning methodologies to ensure they appropriately value all attributes of CHP systems, facilitating utility consideration of rate-base investment in CHP.

- d. *CHP size limitations*: Study effects of Minn. 216H(3) on CHP potential and develop legislative options to avoid unintended consequences.
- e. *Integrated resource planning (IRP)*: Amend IRP processes to ensure potential CHP capacity is fairly and thoroughly considered in utility long-term resource planning.
- f. *On-bill repayment for CHP investments*: Develop on-bill repayment mechanisms to facilitate customer investment in onsite energy systems, including CHP.
- g. *Conservation Improvement Program (CIP)*: Revise existing provisions in the CIP statute to encourage investments in CHP by providing additional energy savings goals and incentives to be attained through improvements in power generation efficiency.

These recommendations are intended to remove unnecessary barriers, encourage cost-effective investment, and establish State support for CHP as an energy-saving solution. Further development and analysis of these recommendations will help to clarify priorities, methodologies, and cost-benefit factors, so the CHP Action Plan can bring the greatest benefits for Minnesota's energy customers, economy, and environment.

Chapter I: Approach and Outcomes

A. Engagement Process Summary

a. Background

In late 2013, as part of the Energy Savings Goal Study required by the state legislature, the Minnesota Department of Commerce (“Commerce”) conducted a series of stakeholder meetings on industrial energy efficiency and combined heat and power (CHP) – including two technical work group meetings focused specifically on CHP – and delivered a report on findings and recommendations to the legislature.

In 2014, Commerce funded two CHP research projects that are specific to Minnesota. One study evaluates CHP regulatory issues and policies and develops an up-to-date analysis of CHP technical and economic potential; another study examines the effects of existing standby rates and net metering rules on CHP and waste heat to power projects.

To continue to build on Commerce’s past and current CHP work, and to focus on more specific policy details and recommendations, Commerce was awarded a U.S. Department of Energy grant to carry out a strategic stakeholder engagement process and develop an Action Plan. The process included three primary components: a series of stakeholder engagement meetings, a public comment period, and a series of stakeholder surveys.

b. Stakeholder Meetings

During the fall of 2014, Commerce convened a series of four stakeholder engagement meetings to provide information and facilitate discussion on CHP issues involving Minnesota’s regulatory framework, technical/economic potential, and education/training needs. These meetings were intended to achieve several primary objectives:

- Inform stakeholders about CHP opportunities, barriers, and policy options
- Facilitate discussion regarding CHP potential and policy proposals
- Solicit ideas for possible options and solutions
- Synthesize information for the development of a CHP Action Plan, which will act as a roadmap to facilitate greater implementation of CHP projects throughout the state

During July 2014, Commerce scheduled the four stakeholder meetings to occur in September, October, and November, at the Wilder Center in St. Paul. Commerce provided invitations to a list of approximately 100 people, representing a broad cross-section of companies, organizations, and agencies with interest in Minnesota’s CHP

market. To develop the format and content of each meeting, Commerce worked with contractors Microgrid Institute, FVB Energy, and the Energy Resources Center. All four meetings were facilitated by Microgrid Institute.

The CHP meetings were formatted and conducted to address specific objectives, namely providing information, clarifying understanding, facilitating discussion, obtaining input, and synthesizing information. The first two meetings focused more on presenting and clarifying information, and the later two meetings provided greater opportunity for input and discussion. This approach facilitated informed discussion of CHP-related issues and policy proposals, and yielded a wealth of information and interaction to support Commerce’s analysis of policy options.

Mtg.	Date	Focus Topic(s)	Objectives	Format
#1	9/3/14	CHP Baseline, Value Proposition, and Path Forward	Inform stakeholders re: CHP in Minnesota and FVB Energy proposed policy options	Presentations and moderated Q&A
#2	9/24/14	CHP U.S. Policy Context and Standby Rates	Clarify stakeholders’ understanding of key policy issues affecting CHP	Presentations and moderated discussion
#3	10/15/14	Stakeholder Panels – CHP Economic Potential and Policy Options	Share and discuss perspectives of several key stakeholder organizations and commenters	Moderated panel presentations and discussion
#4	11/5/14	Discussion and Synthesis of Major Themes	Obtain stakeholder comments and suggestions	Moderated discussion and synthesis of information

c. Comment Period

Commerce convened a public comment period from September 24 through October 10, between stakeholder meetings #2 and #3. Commerce invited stakeholders to submit written comments regarding issues and factors affecting CHP deployment, suggesting that commenters focus on the following topics:

- FVB Energy’s proposed CHP policy options
- CHP finance, policy, technical applications, and education and training needs
- Alternative mechanisms and approaches to facilitate economically efficient deployment of CHP in Minnesota
- Current barriers and issues hindering CHP projects

- Resource planning, strategic, and regulatory factors affecting CHP options and potential

Microgrid Institute compiled the submitted comments and synthesized them in a summary report (*see Appendix D*), which was made publicly available and summarized for discussion at Meeting #3.

d. Stakeholder Surveys

To gather information about stakeholders' perspectives on issues related to CHP in Minnesota, and to gauge changes in perspectives during the course of the stakeholder engagement process, Commerce commissioned Microgrid Institute to prepare and conduct a series of surveys (*see Appendices A, B, and C*):

- A pre-engagement online survey obtained information regarding stakeholders' experiences with CHP and perspectives on factors affecting CHP development and operation.
- A telephone interview survey gathered supplementary comments from selected stakeholders.
- A post-engagement online survey obtained additional information and tracked changes in stakeholder perspectives on factors affecting CHP.

The pre-engagement survey questions were divided into five categories: Demographics and CHP Experience; Policy; Resources and Technology; Market Potential; and Finance. Respondents reported mostly favorable experience and perceptions about CHP's operational attributes, and mixed opinions about market and policy factors affecting development and ownership.

The post-engagement survey included some of the same topical questions as the pre-engagement survey, allowing Microgrid Institute to gauge changes in respondents' perspectives over the course of the engagement process. The most noteworthy shifts involved responses regarding standby rates. Post-engagement survey respondents identified standby rate policy as the most important hindrance to customer or third-party CHP development, compared to its third most-important rating in the pre-engagement survey. Post-engagement respondents also selected transparent and fair standby rate policies as the most effective among a list of possible policy initiatives to facilitate CHP deployment.

At the same time, however, more respondents in the post-engagement survey indicated that standby rate policies are fair and non-discriminatory toward customer/third-party CHP (46 percent agreement vs. 19 percent in the pre-engagement survey). Similarly, respondents also increased their estimation of the fairness of utility interconnection

policies (44 percent in the post-engagement survey agreed they are fair and non-discriminatory, compared to 30 percent pre-engagement) and net-metering tariffs (up to 40 percent from 19 percent).

Finally, more respondents in the post-engagement survey indicated disagreement with a statement that commercial financing allows CHP system payback periods sufficient to support economic deployment (71 percent disagreed or strongly disagreed in the post-engagement survey, vs. 46 percent pre-engagement). Conversely, however, a greater percentage of respondents agreed that CHP systems are cost-effective enough to allow substantial new deployment (32 percent vs. 26 percent pre-engagement).

The post-engagement meeting survey results suggest that respondents believe the following are among the most important initiatives² the state could implement to facilitate CHP deployment:

1. Introduce transparent, unbundled pricing for standby rates (43 percent)
2. Establish CHP project evaluation methodologies and criteria (39 percent)
3. Include CHP as a supply-side opportunity in the Electric Utility Infrastructure (EUI) program under CIP (38 percent)

Respondents' #1 rating of standby rate transparency reflects stakeholders' expressed interest during CHP stakeholder engagement process in ensuring standby rate policies are effective and fair. Likewise, stakeholders' survey responses are consistent with their expressed interest in proposed initiatives to establish standard CHP project evaluation methodologies and CIP EUI provisions for CHP.

e. Information Synthesis and Deliverables

During the CHP stakeholder engagement process, information was compiled, summarized, and reported in multiple forms – both for stakeholders as well as the State of Minnesota.³ These materials included: i. Background Reports and Resources; ii. Meeting Presentations and Summary Reports; iii. Meeting Handouts; iv. Comment Period Synthesis Report; and v. CHP Stakeholder Survey Reports.

² *i.e.*, They ranked these issues among the three most effective policy initiatives to facilitate CHP deployment in Minnesota.

³ All reports, presentations, handouts, and other materials were made available via Commerce's website here:
<http://mn.gov/commerce/energy/businesses/clean-energy/distributed-generation/2014-workshops/chp-meetings.jsp>

- i. Background Reports and Resources: Several related reports and other documents were made available to stakeholders during the engagement process. These documents included the following reports (*commissioned separately by Commerce unless noted otherwise*):
 - FVB Energy Reports:
 - [Minnesota CHP Policy Brief](#)
 - [Minnesota CHP Regulatory Issues and Policy Evaluation](#)
 - [Minnesota CHP Technical and Economic Potential](#)
 - University of Illinois-Chicago Energy Resources Center Report:
 - [CHP Standby Rates and Net Metering Report](#)
 - Microgrid Institute Report
 - [Minnesota Microgrids: Barriers, Opportunities, and Pathways toward Energy Assurance](#)
 - Minnesota Department of Commerce Report:
 - [Energy Savings Goal Study Legislative Report](#)
 - Regulatory Assistance Project (*commissioned by Oak Ridge Nat'l Lab*)
 - [Standby Rates for CHP Systems](#)
- ii. Meeting Presentations and Summary Reports: Commerce, Microgrid Institute, FVB Energy, and other participants delivered presentations during the stakeholder engagement meetings. Additionally, Microgrid Institute prepared meeting summary reports, which Commerce distributed to stakeholders and posted on its website following each meeting. These meeting materials included the following:
 - a. Meeting #1:
 - [Department of Commerce Presentation](#)
 - [Microgrid Institute Presentation](#)
 - [FVB Energy Presentation](#)
 - [Meeting #1 Summary](#)
 - b. Meeting #2:
 - [Microgrid Institute Presentation](#)
 - [U.S. DOE CHP TAP Presentation](#)
 - [The Brattle Group Presentation](#)
 - [Department of Commerce Presentation](#)
 - [Energy Resources Center Presentation](#)
 - [Meeting #2 Summary](#)
 - c. Meeting #3:
 - [Department of Commerce Presentation](#)
 - [Microgrid Institute Presentation](#)
 - [Meeting #3 Summary](#)

- d. Meeting #4:
 - [Department of Commerce Presentation](#)
 - [Microgrid Institute Presentation](#)
 - [Meeting #4 Summary](#)
- iii. Meeting Handouts: For the first two stakeholder engagement meetings, Microgrid Institute prepared handouts comprising background information on relevant topics, and Commerce distributed these handouts to attendees and also made PDF versions available via the Commerce website. Handouts focused on the following CHP-related issues:
 - a. Meeting #1
 - [Technical and Economic Potential](#)
 - [Baseline and Value Proposition](#)
 - [Energy Policy Context](#)
 - b. Meeting #2
 - [Standby Rate Design Elements](#)
 - [CHP and State Portfolio Standards](#)
- iv. Comment Period Synthesis Report: Microgrid Institute synthesized and analyzed comments submitted during the comment period (September 24 through October 10) and prepared a [summary report](#), which Microgrid Institute reviewed during Meeting #3, and which Commerce distributed to stakeholders and made available on its website. Comments were submitted by 13 organizations, addressing several interrelated topic areas:
 - Policy Options
 - Capital Costs and Utility Investment Prospects
 - Economic Potential and Value Proposition
 - Standby Rates
 - Training and Education Needs
- v. CHP Stakeholder Survey Reports: Microgrid Institute analyzed the results of the pre- and post-engagement stakeholder surveys, and prepared reports presenting the results and summarizing the survey results.
 - [Pre-Engagement Survey Results Report](#)
 - [Post-Engagement Survey Results Report](#)

B. Options and Outcomes

The CHP Stakeholder Engagement process included exploration of numerous policy options and other potential initiatives, and produced substantive debate and discussion. Most of the discussion focused on options in four areas: i. FVB Energy's Policy Options; ii. Standby Service Pricing Policies; iii. Additional Policy Options; and iv. Information, Tools, and Other Resources.

- i. CHP Policy Options: During the stakeholder engagement process, participants were presented with a series of CHP policy options proposed by FVB Energy (e.g., to add CHP provisions to Minnesota's Conservation Improvement Program (CIP); to establish goals for CHP deployment as part of the state's existing renewable portfolio standard (RPS); or to establish CHP goals as part of a prospective alternative portfolio standard (APS)). Additionally, participants discussed options to encourage consideration of CHP through utility integrated resource planning (IRP) processes before the Minnesota Public Utilities Commission (PUC).

The process revealed various perspectives and ideas on these options. To briefly summarize outcomes:

- *While some participants support the potential for an APS to achieve the most substantial CHP deployment, many observers note that an APS likely would face the most serious legislative challenges.*
 - *The concept of creating new CIP goals to provide incentives for topping-cycle CHP raised concerns about using a program intended primarily to fund demand-side conservation to support new generation investment.*
 - *Revising the Electric Utility Infrastructure (EUI) provisions of CIP to accommodate and encourage CHP investment generated more support than other options, with a majority of participants seeming to agree that this alternative holds promise and bears further development.*
 - *Encouraging CHP through utility IRP processes generated some interest but also doubt that such a long-range planning context can effectively accommodate CHP projects, which tend to be driven by local situational factors rather than system-wide resource planning considerations.*
- ii. Standby Service Pricing Policies: Stakeholders expressed divergent opinions about whether standby service tariffs represent a general barrier to CHP deployment, with some suggesting that they substantially hinder specific projects, and others dismissing their overall effect. With notable exceptions, however, most participants expressed support for the PUC's rulemaking inquiry to ensure that standby service tariff policies are transparent, fair, and not unduly discriminatory.

- iii. Additional Policy Options: In addition to these perspectives on proposed policy options, stakeholders suggested and discussed additional policy options. Examples included:
- *On-bill repayment programs* that could allow customers to access CHP affordably. Such programs have produced benefits in some other states and many participants expressed interest in their development in Minnesota.
 - *Clarified options for utility behind-the-meter investments* within existing policy frameworks – including provisions for stranded-asset risks in the event of declining thermal load. Uncertainty about regulatory treatment for rate-base investments on a customer site limits utility interest in considering CHP.
 - *Provisions for the PUC to evaluate non-cost factors* when considering approval for utility rate-base investments in CHP. Inflexible least-cost planning principles have prohibited utility investments in CHP in the past.
 - *Transparent and fair avoided-cost calculation methodologies.* Some stakeholders allege that utilities' current avoided-cost pricing methodologies are opaque and inaccurate, yielding avoided cost rates that under-value third-party and customer-owned generation resources.
 - *Clarified utility regulatory treatment:* Utilities and other stakeholders refer to uncertainties regarding regulatory treatment and interpretation on many issues, and these uncertainties discourage active development. Examples: 1) Would/should utilities have right of first refusal to develop CHP projects that benefit from State incentives?; 2) Some municipal utilities suggest that losing anchor-tenant customer load to onsite generation would impair utility revenue requirements. How will potential cross-subsidies be identified and mitigated?; 3) Some electric utilities object generally that CHP incentives result in fuel switching in favor of natural gas utilities, and moreover; 4) As a baseload resource, non-dispatchable CHP could be seen to displace night-time wind generation with natural gas-fired generation. Policy guidance or decisions on these and other related issues could clarify and support CHP development options.
- iv. Information, Tools, and Other Resources: In addition to policy development, stakeholders expressed support for State efforts to provide information, tools, and other resources to help cultivate CHP opportunities in ways that are not well supported by private-sector products and services. Examples:
- *CHP project evaluation methodologies and criteria:* Establishing standard approaches to assessing, measuring, and valuing CHP project attributes would help utilities and developers to focus development resources, and

also would clarify valuation factors affecting the State's CHP policy development efforts.

- *CHP potential studies:* Clearer understanding of opportunities for CHP investments could spur project development. Many stakeholders support the idea of a State-sponsored effort to “map” waste heat sources and high-value sites for priority development.
- *Training and education resources:* Gaps in knowledge about CHP opportunities and issues among leaders in the commercial, industrial, and institutional sectors tend to stifle project opportunities and hinder development. Minnesota's CHP Training & Education Plan includes several options to advance market understanding of CHP and related issues, and to identify ways the State can support development of qualified technical professionals to address a range of onsite energy needs, from building automation to CHP operations and maintenance. Additionally, in-house resources to perform project feasibility studies and carry projects forward typically are limited at companies that could benefit from CHP investments. Accordingly the plan prioritizes training and ongoing support for CHP projects following standard evaluation methodologies and criteria, as described in II.-B-i (*below*).

Chapter II: CHP Action Plan Recommendations

The 2014 Minnesota CHP Stakeholder Engagement process provided Commerce with a wealth of information about stakeholders' perspectives on CHP, as well as various options for overcoming barriers to new CHP⁴ deployment. During the process, Commerce sought and yielded detailed comments from a broad cross-section of stakeholders in the state, allowing Commerce to formulate and implement a CHP Action Plan that is grounded firmly on the needs and concerns of Minnesota's energy consumers and producers, as well as the state's economy and natural resources.

A CHP Action Plan could lead toward substantial improvements to Minnesota's energy economy in three ways:

- 1) Establishing clear strategic goals for deployment of CHP in Minnesota, in the context of the State's emerging energy future vision, as well as its economic, environmental, and security goals.
- 2) Producing information, tools, and other resources needed to properly understand, evaluate, and exploit CHP opportunities.
- 3) Providing policies that enable and encourage competitive commercial investment in efficient CHP, consistent with the State's energy, environmental, economic, and resilience goals.

A. Policy vision and strategic goals

The studies, reports, and presentations examined during the stakeholder engagement process provided exhaustive analysis of issues affecting CHP deployment. Taking action on that analysis now requires establishing clarity about the State's strategic goals for CHP. Microgrid Institute recommends that Commerce's CHP Action Plan should propose language establishing these strategic goals, to inform subsequent legislative and regulatory policy efforts and guide them toward a clear strategic vision. Such goals might include deploying new CHP sufficient to:

- *Increase the average efficiency of the state's electric and thermal generation systems by a defined percentage*, derived through objective empirical studies demonstrating technical and economic viability for CHP in new deployments and upgrades at existing facilities. Such a goal addresses generation-system efficiency separately from demand-side efficiency, and provides specific treatment for CHP to ensure its full scope of economic, environmental, and energy security benefits can become available to Minnesota customers.

⁴ In many cases, policies affecting CHP also affect other forms of distributed generation. This report focuses primarily on CHP and its unique attributes, but Microgrid Institute recommends a holistic approach to policy development that considers all relevant alternatives and provides appropriate mechanisms and incentives to support the options that are most beneficial for Minnesota.

- *Reduce the aggregate greenhouse gas (GHG) emissions of the state's generation by a defined amount*, again derived through empirical study. Establishing a CHP-specific GHG reduction goal would clarify that the State's strategic interests in CHP include – but are not limited to – environmental benefits. Moreover, while the State's CHP goals must be consistent with its environmental policies, they should not be dependent on general promulgation of emissions standards.
- *Improve the resilience of local energy systems*, as defined by metrics for service interruptions of all kinds, including storm and other events not always included in standard utility reliability indices. CHP and other distributed energy systems can be designed and operated to support local resilience, and establishing resilience goals will clarify the State's interest in CHP deployment for this purpose.
- *Support the State's transition toward a modern, clean, and robust energy system*, in which customers and communities can readily adopt advanced energy technologies, and clean distributed energy systems can economically provide utility services historically provided almost exclusively by dirtier and less-efficient centralized systems.⁵ CHP goals in the context of modernization planning will express the State's interest in capturing the benefits of technology advancement for the state's economy, and managing an orderly transition to a clean, distributed energy paradigm. In particular, as older and less-efficient coal-fired power units are retired, CHP goals can help ensure they are replaced with highly efficient and clean generation resources.

Minnesota's strategic vision for CHP will be most informative and effective if its goals seek to bridge political differences, and if they are sensitive to the economic and operational realities of the state's energy market stakeholders. These goals will be most likely to yield tangible benefits for the state if they are derived through objective study data, and if they consider the strategic business interests of all major market sectors.

Specifically, stakeholders have identified utility strategic business interests as a primary barrier to CHP deployment. Minnesota's CHP policies will produce the best results if they weigh utility business interests appropriately against the benefits of CHP deployment, and avoid imposing unnecessary burdens on legacy interests – while also encouraging disruptive innovation that will benefit Minnesota. The following information resource and policy action recommendations are intended to suit such a balanced approach.

⁵ See *Phase I Report: Charting a Path to a 21st Century Energy System in Minnesota*, e21 Initiative/Great Plains Institute, December 2014.
http://www.betterenergy.org/sites/www.betterenergy.org/files/e21_Initiative_Phase_I_Report_2014.pdf

B. Studies, research, and resource development

The State of Minnesota can substantially advance potential for CHP deployment by developing certain key information resources, otherwise unavailable from other sources. They include: i. CHP evaluation methodologies and criteria; ii. CHP Potential Studies; and iii. Training and education resources.

Note: Successful implementation of Minnesota's CHP Action Plan will depend on priority training, education, outreach, and ongoing support efforts. More detailed recommendations on training and education are provided in the CHP Training and Education Plan (*see Chapter III*).

- i. CHP evaluation methodologies and criteria: Prioritize a research and development (R&D) project to establish standard approaches for assessing, measuring, and valuing CHP project attributes.

Such standard methodologies and criteria would help utilities and developers to focus development resources, and would provide vital common frameworks for assessing and encouraging CHP through legislation and regulation.

Minnesota's CHP project evaluation methodologies and criteria will be most effective if they consider a comprehensive set of attributes, and if they value those attributes in ways that are empirically supported and objectively fair with regard to the interests of customers, utilities, and the state. Furthermore, evaluation approaches that are transparent and easily understood will be most likely to achieve sustained support from key stakeholder groups.

During the engagement process, stakeholders identified numerous criteria and factors for consideration in developing such methodologies and criteria. (*see Appendix H*). Additionally, Microgrid Institute prepared a working list of relevant evaluation models, criteria, programs, and studies⁶ from other states and jurisdictions. These resources provide a solid foundation for developing Minnesota's CHP evaluation methodologies and criteria.

- ii. CHP potential studies: Study and report technical and economic potential for CHP projects in the state. Such efforts would expand upon work already performed under commission by Commerce,⁷ by identifying and

⁶ Appendix H and <http://www.microgridinstitute.org/project-evaluation-methodologies-criteria-and-resources.html>

⁷ See *Minnesota Combined Heat and Power Policies and Potential, CARD Final Report*, FVB Energy and ICF International, July 2014.
<http://mn.gov/commerce/energy/images/CHPTechnicalandEconomicPotential.pdf>

characterizing existing sources of waste heat and high-value sites for potential development.

In addition to characterizing efficiency, environmental, and economic potential for CHP at these facilities, Microgrid Institute recommends that such study efforts should seek to identify needs for onsite power to serve critical resilience and emergency preparedness objectives; local economic development needs and opportunities; and the potential for small-scale packaged CHP installations. As a related matter, training and ongoing support for project feasibility analysis will help potential CHP hosts and sponsors to focus resources on projects most likely to produce value – in terms of economics and other public benefits and factors (*See Chapter III*).

Studies can be effectively prioritized as follows to produce the greatest understanding of CHP potential in the state:

- *Priority 1: Public facilities* – Colleges and universities, hospitals and assisted living facilities, public housing, prisons, etc. The State already has access to some data on these facilities and sources of additional information about them.⁸
- *Priority 2: District energy systems* – Including potential for expansion of existing systems as well as development of new integrated community energy systems in Minnesota. Such study efforts could bring district energy benefits to more communities.
- *Priority 3: Private-sector potential* – Commercial, industrial, and non-public institutional facilities. The State could encourage utilities to study and select CHP sites for development, toward meeting state goals and utility system objectives, including transmission, distribution, and generation resource adequacy.

iii. Training and education resources: Gaps in knowledge and competencies tend to stifle project opportunities and hinder development. Microgrid Institute recommends that Commerce implement the CHP Training and Education Plan contained in Chapter III. In sum:

- Support implementation of Minnesota policies and standards by providing training, information, and ongoing expertise.
- Address key knowledge gaps and resource deficiencies that hinder development of CHP projects.
- Strengthen Minnesota’s education and training resources as needed to ensure availability of onsite energy management professionals.

⁸ <https://mn.b3benchmarking.com/>

C. CHP policy development

In addition to establishing strategic goals and providing evaluation and information tools, the State of Minnesota can foster CHP development substantially by reducing or removing policy barriers and providing affirmative policy support for CHP projects. Microgrid Institute recommends including the following policy development measures in Minnesota's CHP Action Plan:

- i. Utility standby service pricing: Amend the State's standby rate policies to ensure fairness, efficiency, and transparency, as reflected in guiding principles and recommendations identified by the Regulatory Assistance Project.⁹ By adopting these principles, the State of Minnesota (most notably the PUC) would help ensure that standby rate policies are fair, effective, and efficient, and that they serve to enable rather than hinder deployment of beneficial CHP facilities. For example:
 - Standby service pricing should reflect market-based costs, including time-of-use (TOU) pricing to reward efficient use of standby service.
 - Generation, transmission, and distribution charges should be unbundled in standby pricing schemes to ensure transparency.
 - Policies and procedures should allow simple and accurate forecasting of standby service costs.
 - Policies should permit customers to self-dispatch, reduce load, and procure market resources to meet standby requirements.
 - Generation reservation demand charges should be based on the utility's cost and the customer unit's forced outage rate.
 - Daily standby demand charges should be pro-rated.
 - Delivery charges should factor-in ancillary benefits, including demand response services, peak-load reduction, and load diversity on shared distribution facilities.
- ii. Avoided-cost calculation: Examine utility avoided-cost calculation methodologies, as used by the PUC in rate-recovery proceedings, and propose policy changes as necessary to ensure avoided costs are established in ways that are accurate, fair, and transparent, and that properly value CHP in comparison to the generation cost it would avoid.

Avoided costs based on a utility's marginal costs of existing generation can under-value CHP systems that would allow the utility to avoid future

⁹ "Designing Standby Rates Well," presentation by Carl Linvill, Regulatory Assistance Project for the Minnesota Department of Commerce Standby Rates Workshop, Sept. 11, 2014.
<http://mn.gov/commerce/energy/images/RAP-DesigningStandbyRatesWell.pdf>

generation additions costing more than existing generation. Inappropriately low avoided-cost calculations can impair CHP facility economics, resulting in less-efficient facilities and longer payback periods. Reviewing and updating utilities' avoided-cost calculation practices would help ensure that cost-effective CHP plants are fairly compensated for the value they produce.

- iii. Least-cost utility planning: Amend least-cost utility planning methodologies to ensure they appropriately value all attributes of CHP, and not just their electric generation outputs. This policy action by the PUC would facilitate utility consideration of rate-base investment in CHP.

As applied to CHP projects, least-cost planning methodologies will produce the greatest benefit for Minnesota customers if they are consistent with the CHP project evaluation methodologies and criteria described in B-i above.

- iv. CHP size limitations: Study effects on CHP potential of Minnesota Statute 216H(3)¹⁰ (limiting the size of new fossil-fueled baseload generation to less than 50 MW), and recommend policy changes as appropriate to enable CHP projects to produce optimal efficiency improvements, consistent with Minnesota's environmental policies and CHP strategies.

Minnesota's legislative moratorium on new large-scale fossil-fueled power plants may have the unintended effect of preventing development of cost-effective large CHP facilities that could displace, for example, coal-fired boilers or power plants that produce substantially more emissions per unit of useful energy. Microgrid Institute recommends developing alternative legislative language or regulatory waiver processes allowing development of larger CHP facilities that produce environmental benefits.

- v. Integrated resource planning (IRP): Amend IRP processes to ensure potential CHP capacity is fairly and thoroughly considered as an alternative for meeting the state's future generation and transmission resource needs.

Minnesota's IRP processes will produce the greatest benefit for the state's energy consumers, economy, and environment if they consider CHP potential in ways that are substantially informed by the methodologies and studies described above in B-i and B-ii, respectively.

- vi. On-bill repayment for CHP investments: Study the potential for on-bill repayment mechanisms to facilitate customer investment in onsite energy systems, including CHP, and develop appropriate policy measures to provide

¹⁰ Minnesota Statute 216H(3)
<https://www.revisor.leg.state.mn.us/statutes/?id=216H.03>

such mechanisms. On-bill repayment programs in some states show promise for allowing energy customers to access affordable financing for energy system upgrades. Such mechanisms could ensure customers can access competitive alternatives to utility-financed CHP.

- vii. Conservation Improvement Program (CIP): Revise existing provisions in the CIP statute¹¹ to encourage investments in CHP, by providing additional energy savings goals and incentives to be attained through improvements in power generation efficiency.

Stakeholder comments suggest that one viable approach to encouraging CHP through CIP would involve revising CIP's electric utility infrastructure (EUI) provisions. These provisions currently allow a utility to count toward its CIP goals¹² those energy savings that result from qualified improvements to its generation, transmission, or distribution infrastructure, or conservation measures at its own facilities – but only after plans are in place to achieve at least 1 percent energy savings using demand-side conservation measures.

Notably, revising CIP to establish additional energy savings goals to be achieved with supply-side efficiency improvements could facilitate targeted investments in CHP without placing undue burden on budgets and administration resources established primarily to encourage demand-side conservation.

¹¹ See *Minnesota Statute 216B.241*

<https://www.revisor.mn.gov/statutes/?id=216B.241>

¹² Generally, to save energy equal to 1.5 percent of annual retail energy sales, including at least 1 percent energy savings through conservation improvements.

Chapter III: CHP Training and Education Plan

As part of the CHP stakeholder engagement process, Commerce contracted Microgrid Institute to identify gaps in knowledge and skills, consider training and education options, and produce a set of recommendations to support CHP deployment in the state.

A. Needs and Goals

To ensure that proposed solutions are responsive to the critical needs of market participants, Microgrid Institute gathered input and led discussion on training and education topics during the CHP stakeholder engagement process. This information is reflected in several summary reports (*see appendices*), most notably:

- Pre-Engagement Survey Report
- Post-Engagement Survey Report
- Comment Period Synthesis Report
- Meeting #4 Summary Report

Analysis of survey responses and meeting discussion content shows that stakeholders perceive three primary gaps in market knowledge and workforce resources:

- *CHP options and opportunities:* Some key stakeholder groups – most notably including prospective end-use customers – lack knowledge and understanding about CHP systems and their potential.
- *Regulatory, finance, and development issues:* CHP development processes and factors are perceived as complex and uncertain, which tends to discourage decision makers from exploring and pursuing CHP development.
- *Onsite energy staffing:* Workforce and training resources may be inadequate to support needs among prospective users of CHP and other onsite energy systems, including energy management and efficiency solutions.

To address these needs and support Minnesota’s CHP Action Plan efforts, Microgrid Institute recommends a series of training and education development steps, each of which serves one or more of the following goals:

- *Support implementation of Minnesota policies and standards*
- *Facilitate cost-efficient CHP project development*
- *Assist development of qualified CHP workforce*

Recommended action steps are categorized in three groups: CHP evaluation methodology training and support; CHP outreach and development support; and technical workforce development.

- #### B. CHP Evaluation Methodology Training and Support:
- Among priorities identified through the CHP stakeholder engagement process, CHP evaluation methodologies

and criteria are considered critical to support project development and establish a consistent framework State policy implementation. Accordingly, training, information, and support services will be needed help support understanding and market adoption of these standard methodologies and criteria. Stakeholders express interest in various kinds of resources and programs, including training workshops, online webinars, guidelines and tutorials, and ongoing technical support.

Microgrid Institute recommends developing a comprehensive set of information, training, and support resources for stakeholders as part of the effort to establish standard evaluation methods and tools.

- i. CHP evaluation materials: Information, tools, and guidance to support stakeholders' ongoing CHP development efforts;
- ii. Outreach webinars and workshops: Training to enable stakeholders to adopt and apply Minnesota's CHP project evaluation methodologies and criteria; and
- iii. CHP evaluation support: Ongoing technical assistance for stakeholder efforts to evaluate CHP development opportunities. *Note*: These support resources might also serve the CHP feasibility-study support objectives described in C-v., below.

- C. **CHP Outreach and Development Support**: Stakeholders identify key knowledge gaps and resource deficiencies that hinder development of CHP projects in Minnesota. In particular, CHP development is perceived as complex and uncertain, and potential adopters lack sufficient knowledge and understanding to support effective exploration and development of CHP systems.

Microgrid Institute recommends providing a series of education resources, tools, and technical support services as part of Minnesota's effort to encourage cost-effective CHP deployment – along with outreach and engagement programs to support ongoing development and distribution of information.

- i. CHP information tools and programs: Multimedia resources, case studies, and other information materials supporting stakeholder efforts to research and evaluate CHP generally. Stakeholders identify needs for general information about CHP technologies and projects, and specifically about Minnesota's CHP goals, policies, initiatives, and resources;
- ii. Legal and regulatory workshops: Practical explanation and expert guidance relating to Minnesota laws, policies, and procedures affecting CHP development;
- iii. Interconnection and standby rate policy tutorials: Information and guidance to support stakeholders' understanding of interconnection and standby rate policies in various utility territories;

- iv. Financing resource guide: Guidance and reference information to assist stakeholders in efforts to plan and obtain financing for CHP projects; and
- v. Project feasibility-study support: Training, guidance, and ongoing assistance for stakeholder efforts to study the feasibility of CHP projects. *Note*: These resources might also serve the CHP evaluation support objectives described in B-iii., above.

D. **Technical Workforce Development**: Stakeholders identify deficiencies in Minnesota's workforce and training resources related to onsite energy-management needs, including but not limited to expertise in CHP planning, operations, and maintenance. Microgrid Institute recommends studying these needs in greater detail and providing State guidance and support for technical training as needed to ensure availability of qualified technical professionals.

Note: Because CHP represents one of many solutions for serving onsite energy requirements, specific CHP workforce and training needs can be most effectively addressed in the context of broader energy-management training initiatives.

- i. Workforce review: Empirical study to assess supply and demand for energy-management personnel and characterize workforce deficiencies;
- ii. Professional and technical education review: Survey of training and education programs, opportunities, and needs in Minnesota; and
- iii. Technical education program support: State guidance and support for institutions offering onsite energy management training and education programs. Specific objectives depend on the outcomes of efforts to study and characterize workforce needs, but may include State technical assistance and incentives for program and curriculum development.

E. **Implementation**: The training and education action steps described in this plan are interdependent with other Minnesota efforts to support deployment of CHP and other onsite energy technologies. Moreover, the timeline for implementation of most of these recommendations will depend on related CHP Action Plan efforts – especially development of CHP evaluation methodologies and criteria, as well as policies and programs.

Accordingly, Microgrid Institute recommends developing the CHP Training and Education plan as an integral part of the State's CHP Action Plan. Further, as noted above, efforts to identify needs for technical workforce development can be most effective in the context of broader evaluation of onsite energy-management workforce and training needs. Microgrid Institute recommends considering CHP workforce needs as part of a full scope of world-class training and education resources to serve Minnesota's energy, environmental, and economic goals.

Chapter IV: Conclusion

The Minnesota CHP Stakeholder Engagement process was conceived and executed as a comprehensive project to provide information and obtain feedback from among a broad cross-section of CHP stakeholders in Minnesota. Through a series of surveys, in-person presentations and discussions, reports, handouts, and a comment period, the process sought to inform and engage various individuals according to their particular interests and preferred modes of communication. Moreover, the Minnesota Department of Commerce and its contractors actively performed outreach to ensure that people representing all key stakeholder groups had the opportunity learn and provide input.

The stakeholder engagement process satisfied all objectives established in the project charter, yielding substantial and important results for Minnesota's CHP policy development process. Specifically:

- 1) All four stakeholder engagement meetings were well attended by a cross-section of CHP stakeholders, who consistently offered relevant questions and feedback, and actively participated in moderated discussions.
- 2) The comment period generated numerous in-depth and insightful comment submissions from stakeholders representing various industry sectors and organization types.
- 3) The surveys established clarity regarding stakeholders' experience and perspectives regarding CHP, and provided empirical data to support specific policy-development strategies and priorities.
- 4) Published deliverables contributed substantially to Minnesota's library of information and analysis on CHP topics, and established guidance for further information research, development, and analysis.
- 5) Most stakeholder comments indicated the process and its outcomes were useful and effective.

The Minnesota Department of Commerce expects to apply the information gathered through this process in its efforts to develop a CHP Action Plan for Minnesota. By building its CHP framework on this foundation of stakeholder engagement, the State of Minnesota can ensure that its CHP initiatives are practical, achievable, and effective at helping to support Minnesota's transition to a more efficient, clean, and resilient energy system.

-END OF REPORT-

Appendix A

2014 Minnesota CHP Stakeholder Survey:

Pre-Engagement Results Report

Prepared For:

Minnesota Department of Commerce - Division of Energy Resources

Prepared By:



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Background and Methodology

The 2014 Minnesota Combined Heat and Power (CHP) Stakeholder Perspectives Survey seeks to gauge opinions and knowledge among a sample of people interested in onsite energy options in Minnesota and related regulatory policies and market factors. The Minnesota Department of Commerce, Division of Energy Resources (DER), commissioned the survey as the result of a grant from the U.S. Department of Energy to support stakeholder engagement in the development of a CHP action plan. This longitudinal survey assesses perspectives before and after a series of CHP Stakeholder Engagement Meetings hosted by DER during September, October, and November 2014 in St. Paul.

Initial (pre-engagement) survey questions focused on factors affecting deployment of CHP systems in Minnesota. Survey questions were divided into four categories:

- Demographics and CHP Experience
- CHP Policy
- CHP Resources and Technology
- CHP Market Potential
- CHP Finance

Microgrid Institute developed and administered this survey under the direction and review of DER and its CHP Working Group. To develop survey questions, Microgrid Institute reviewed DER-commissioned reports and other industry literature, and interviewed subject matter experts on CHP markets, policy and legal issues, and finance and economics. Except for demographic questions, the initial (pre-engagement) survey primarily used bounded-continuous answer formats to gauge a range of opinions and perspectives among respondents. Typical questions asked respondents to indicate a range of agreement or disagreement with a series of statements, or asked respondents to rank a series of factors in terms of perceived importance. Microgrid Institute selected these question formats as best-practice methods for gauging changes in perspective over time.

The pre-engagement survey opened on Monday, Aug. 4, with initial notifications distributed via email to 143 recipients. Most recipients completed the survey online, with a few completing the survey by phone. By the survey's close at 5:00 p.m. on Friday, Aug. 15, 45 participants completed valid responses.

Survey Sample

The sample for the CHP Stakeholder pre-engagement survey was comprised of individuals and organizational representatives that DER, the CHP Working Group, and Microgrid Institute expected would be interested in issues addressed during the CHP Stakeholder Engagement Meetings.

Representatives of utilities and government institutions comprised approximately two-thirds of the sample. The remaining one-third was comprised primarily of representatives from end-use companies, CHP technology vendors, consultants, and environmental organizations.

Survey respondents were self-selected—*i.e.*, they opted in to respond to the survey, and Microgrid Institute had limited control over demographic distribution of responses from among the stakeholder sample. Additionally, the survey required respondents to provide valid contact information to determine that A) they were among the sample group and B) whether they would participate in separate interviews on the survey subject. The survey assured respondents that their answers would be treated confidentially by Microgrid Institute and DER, and that survey results would be reported only in aggregate form.

To mitigate limitations with sample size and therefore demographic distribution, survey methodologies prioritized increasing responses among a range of different stakeholder groups. Microgrid Institute and DER conducted reminder email and telephone notifications to increase survey response rates generally, and especially from underrepresented groups (primarily end-use customers), and also to address technical issues affecting survey completion by some participants.

Findings and Analysis

Pre-engagement survey responses reflect a range of knowledge, experience, and opinions related to CHP operations, markets, policies, and economics in Minnesota.

CHP Experience, Technology and Operations: Among respondents with direct or indirect experience owning and operating CHP, most report those experiences have been favorable. Among the 30 percent of respondents reporting direct experience with CHP, 87 percent said their experience was mostly to all favorable, and 53 percent indicated their CHP operations and maintenance (O&M) requirements have been mostly or all easy to manage. (A further 40 percent indicated O&M was partly easy and partly difficult to manage, and 7 percent said it was mostly difficult to manage.) Among the 45 percent of respondents reporting indirect experience with CHP, about 65 percent said their experience was mostly to all favorable, and 35 percent said they were partly or mostly not favorable.

About 32 percent of respondents reported that they currently are considering or working to install a CHP system, with 46 percent of those projects in either engineering and development or construction phases.

Respondents generally indicate positive views toward CHP technologies, with substantial majorities agreeing that CHP technologies today:

- are effective and reliable (84 percent agree or strongly agree);

- produce substantial efficiency improvements (64 percent);
- can use a wide range of fuels (63 percent); and
- can serve a wide range of customer requirements (79 percent).

CHP Policy: Responses regarding CHP policies indicate a mix of perspectives, with generally more responses indicating that current energy policies and regulatory frameworks tend to impede CHP deployment in Minnesota.

A plurality (49 percent) of respondents disagreed or strongly disagreed with a statement that standby power tariffs are fair and non-discriminatory toward CHP systems owned by customers and third parties in Minnesota. By comparison, 19 percent of respondents agreed or strongly agreed with the same statement, and 32 percent neither agreed nor disagreed.

Most respondents ranked utility business interests and strategic conflicts (presumably related to regulatory frameworks) as the most important hindrances to CHP deployment in Minnesota—both by utilities (53 percent ranked as #1 or #2) as well as customers and third parties (63 percent ranked #1 or #2). Inadequate policy incentives were identified as the second most important hindrance to CHP deployment by customers and third parties, while uncertainties about applying CHP toward CIP goals were identified as the second-most important hindrance to CHP deployment by utilities.

Market Potential: Three-fourths (76 percent) of respondents agreed or strongly agreed that many viable sites exist for CHP deployment today. Respondents recognized a range of market factors affecting CHP potential in Minnesota. Among the factors suggested in the survey, the most respondents agreed or strongly agreed that potential for CHP deployment substantially increases with:

- rising electricity prices (84 percent);
- low natural gas prices (79 percent);
- greater knowledge and understanding of CHP (73 percent); and
- greenhouse gas regulation (65 percent).

CHP Economics: Respondents indicated significant doubt about the economics of CHP under current market and policy conditions. For example, a majority of respondents (60 percent) disagreed or strongly disagreed that either efficiency incentives or environmental and renewable incentives adequately support commercial financing for CHP systems.

The survey results suggested ambivalence among stakeholders about whether CHP payback periods are too long. About 46 percent of respondents disagreed or strongly disagreed that commercial financing allows CHP system payback periods sufficient to support economic deployment. However, payback

period and return on investment ranked on average as the #1 most supportive factor affecting CHP economics, with access to affordable capital ranking a close second.

Among respondents who indicated the question applied to them, about half reported that their organizations require a payback periods no longer than either 2 years or 5 years for CHP or similar investments, while the other half can accept payback periods as long as 8 years, 10 years, or more.

Education and Training Needs: Respondents indicated some ambivalence about various talent, education, and training issues. For example, about 47 percent neither agreed nor disagreed that Minnesota's workforce includes ample talent qualified for CHP O&M, with 37 percent agreeing or strongly agreeing with the statement and 10 percent disagreeing or strongly disagreeing. Among areas of education and training, respondents ranked finance, investment, and development, and policy and legal issues as most important. Likewise, strategic understanding ranked #1 among technology and operational hindrances to CHP deployment in Minnesota.

Conclusion and Next Steps

To the degree the State of Minnesota determines that CHP represents a potential solution to achieve the state's energy goals, Minnesota policies should, at a minimum, treat CHP in a fair and nondiscriminatory manner, and regulatory frameworks should avoid discouraging or preventing CHP deployment—either by utilities or customers and third parties.

Accordingly, the results of the CHP Stakeholder pre-engagement survey suggest that efforts to develop a CHP action plan for Minnesota should evaluate the fairness and equity of current policies and regulatory frameworks—especially standby power tariffs, net metering policies, and utility cost-recovery models that discourage CHP deployment by either utilities or customers and third parties. Additionally, efforts should consider uncertainties regarding how CHP can be applied toward meeting Minnesota's energy policy goals, including conservation, renewable energy, and greenhouse gas reduction goals.

Moreover, survey responses suggest that efforts to develop a CHP education and training plan for Minnesota should focus on strategic understanding of CHP as well as related business and legal issues—as opposed to tactical understanding of CHP engineering and O&M, which respondents suggest are less instrumental for future CHP deployment.

Next steps in the Minnesota CHP Stakeholder Engagement Survey involve continued engagement with participants in DER's CHP Stakeholder Meetings, followed by a post-engagement survey. Microgrid Institute anticipates producing a final report presenting the results of the forthcoming post-engagement survey and comparing those results with pre-engagement survey results, to gauge changes in

perspective resulting from engagement and outreach processes, and to further support Minnesota's efforts to develop a CHP action plan.

Questions about either the pre-engagement or post-engagement survey and related reports should be directed to Microgrid Institute:

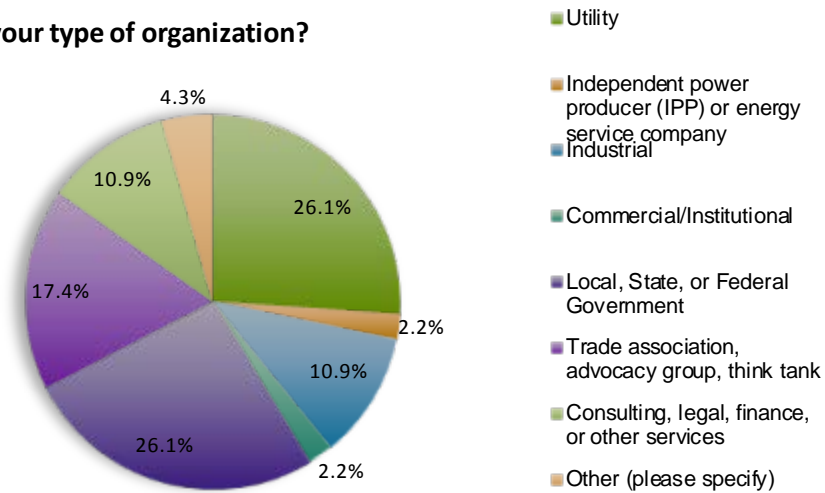
- Peter Douglass (pdouglass@microgridinstitute.org / 320-493-1923)
- Michael Burr (mtburr@microgridinstitute.org / 320-632-5342)

2014 Minnesota CHP Stakeholder Survey: Pre-Engagement Results

Section 1: Demographic Information and CHP Experience

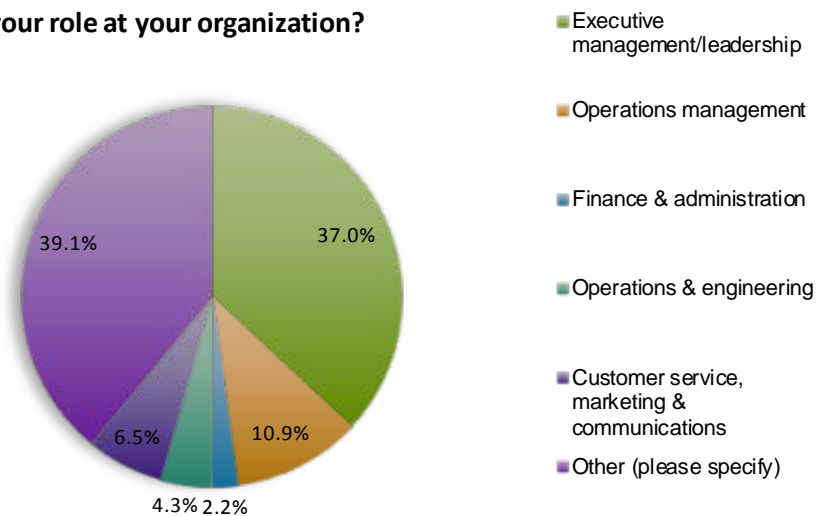
Question 1:

What is your type of organization?



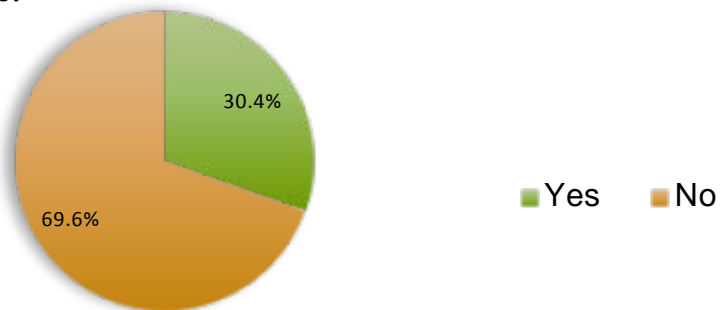
Question 2:

What is your role at your organization?



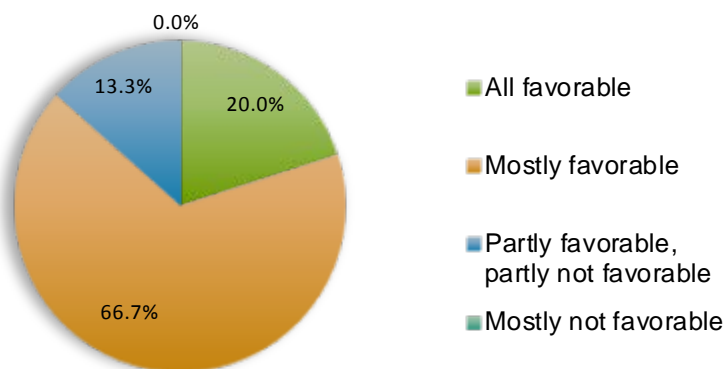
Question 3:

Do you or your organization have direct experience owning and operating CHP systems?



Question 4:

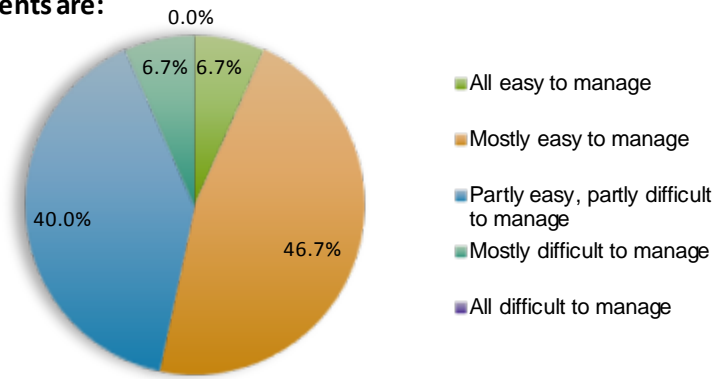
My organization's direct experience with CHP has been:



- 30% of respondents indicated they have direct experience owning and operating CHP systems, of which 87% said their experience was mostly to all favorable.

Question 5:

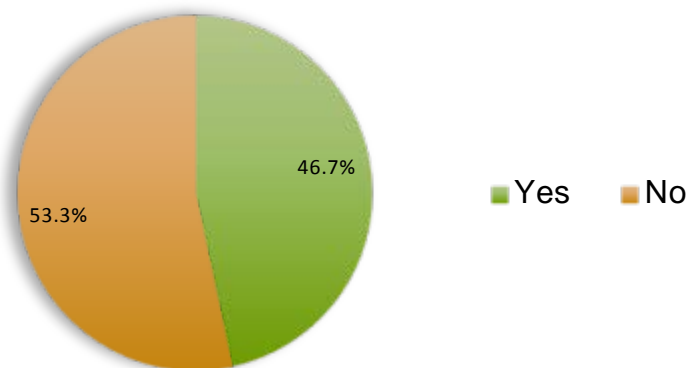
For my organization today, CHP operations and maintenance (O&M) requirements are:



- 53% of respondents stated that their CHP O&M was mostly easy or all easy to manage. The remaining 47% reported O&M was either partly or mostly difficult to manage.

Question 6:

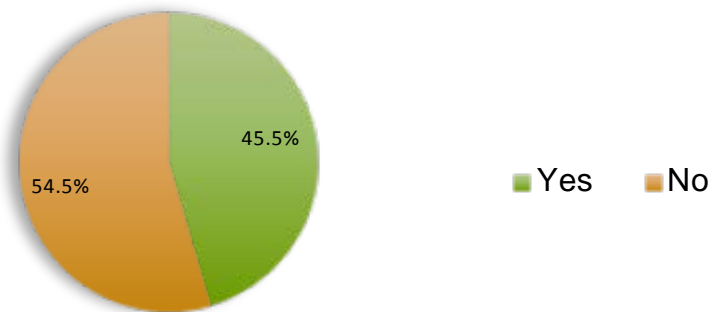
Does your organization sell excess electricity offsite or into the utility grid?



- 47% of respondents with CHP systems sell excess electricity offsite or to the utility grid.

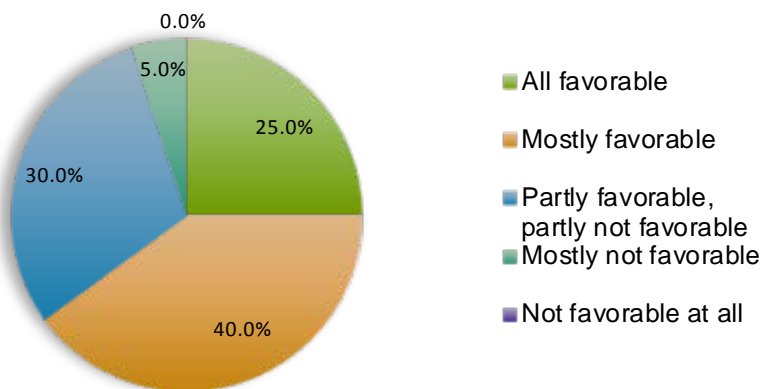
Question 7:

Do you or your organization have indirect experience with CHP systems



Question 8:

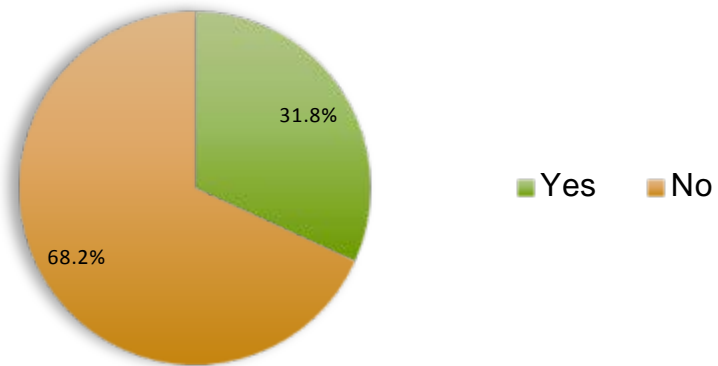
My organization's indirect experience with CHP owned by others has been:



- 46% of respondents indicated they have indirect experience with CHP systems owned and operated by other organizations, of which 65% said their experience was mostly to all favorable.

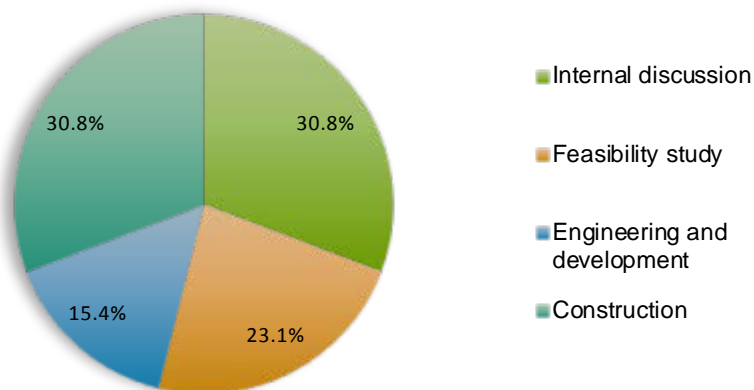
Question 9:

Are you currently considering or working to install a CHP system?



Question 10:

At what stage is your new CHP project?

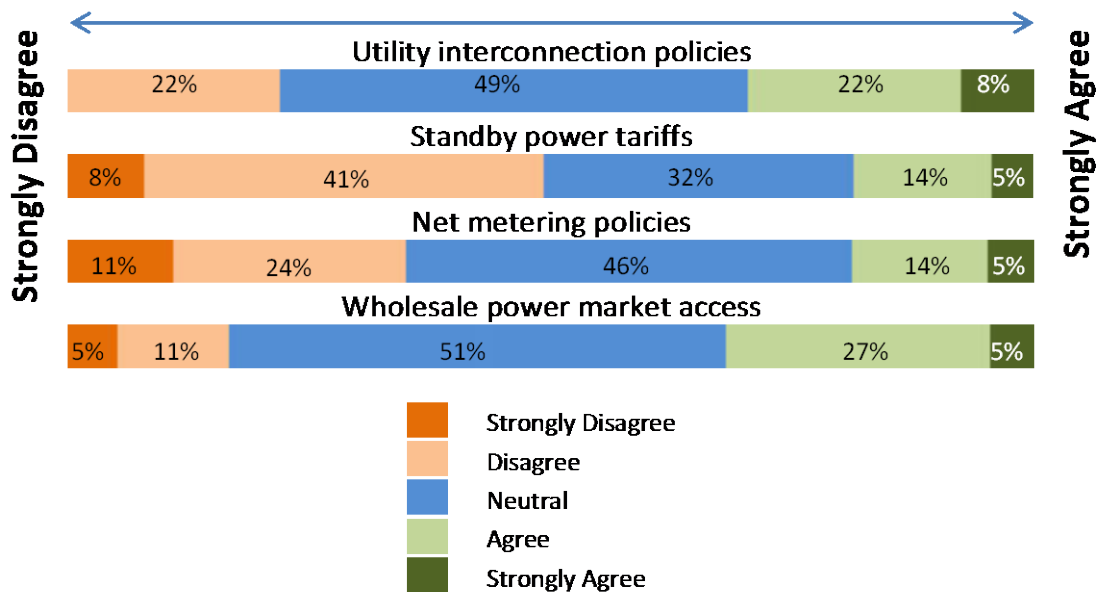


- 32% of respondents indicated they are currently considering or working to install a CHP system. Of those, 46% reported that their planned CHP systems are in engineering and development or construction phases.

Section 2: CHP Policy

Question 11:

Please indicate the degree to which you agree or disagree that each of the following policies is fair and nondiscriminatory towards customer- and/or third-party-owned CHP systems in Minnesota.

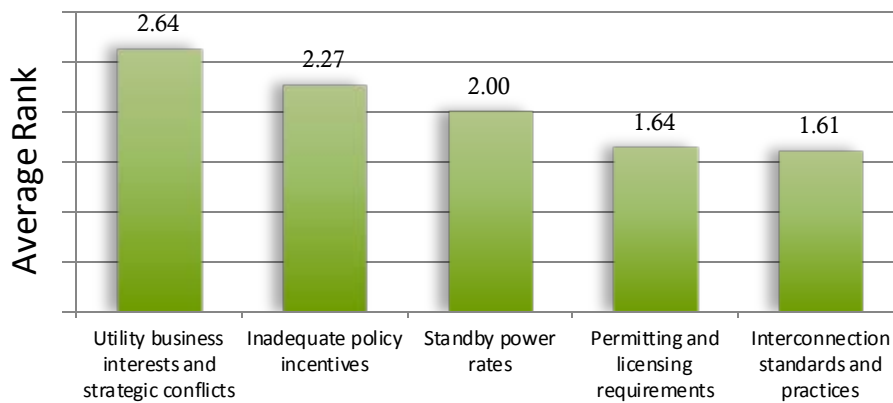


- 49% of respondents disagree or strongly disagree that standby power tariffs are fair and non-discriminatory, while 35% disagree or strongly disagree that net metering policies are fair and non-discriminatory.
- 30% of respondents Agree or Strongly Agree that utility interconnection policies are fair and nondiscriminatory towards customer- and/or third-party-owned CHP systems in Minnesota and 32% Agree or Strongly Agree that access to a wholesale power market is fair and non-discriminatory.

Question 12:

RANK the following policy issues in terms of how substantially you believe they hinder CHP deployment *by customers and third parties* in Minnesota.

Figure 1: Average Rank out of 5



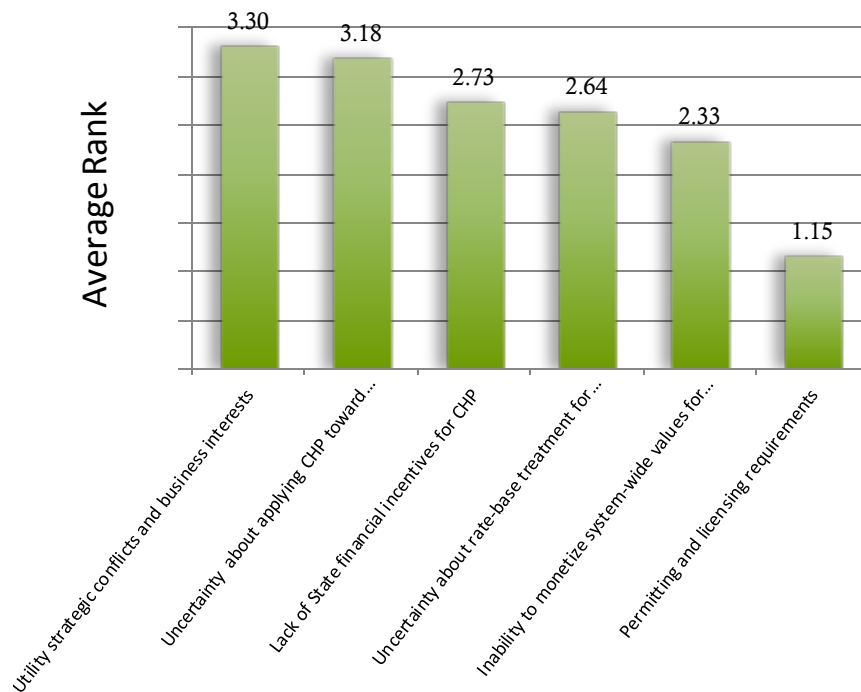
NOTE: Weighted average ranking. (See Appendix A: *Weighted Average Rank Formula*)

- Utility business interests and strategic conflicts along with inadequate policy incentives were ranked as the largest hindrances to CHP deployment by customers and third parties in Minnesota. Standby power rates, permitting and licensing requirements and interconnection standards and practices were ranked 3, 4 and 5 respectively.

Question 13:

RANK the following policy issues in terms of how substantially you believe they hinder CHP deployment *by utilities* in Minnesota.

Figure 2: Average Rank out of 6

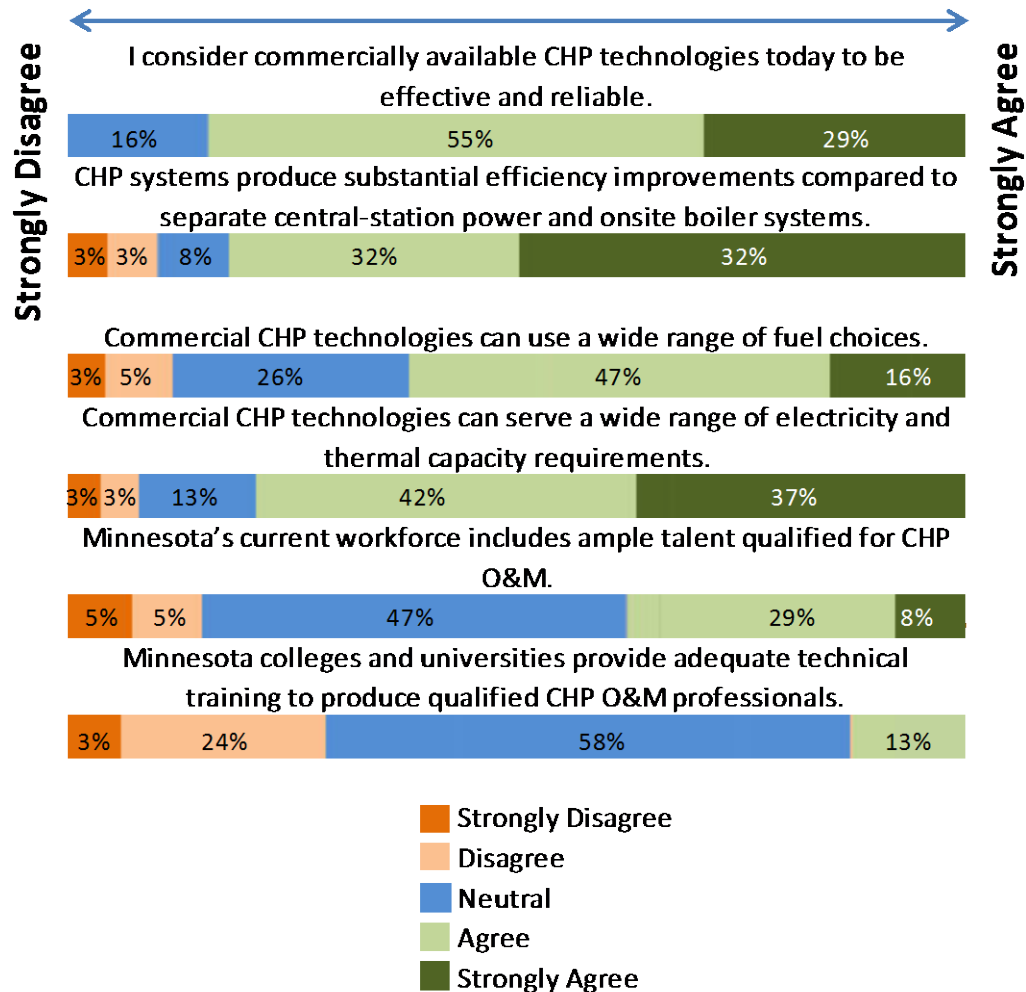


- Utility strategic conflicts and business interests, as well as uncertainty about how to apply CHP toward meeting utilities' CIP goals were ranked as the biggest hindrances to CHP deployment by utilities in Minnesota.

Section 3: CHP Resources and Technology

Question 14:

Please indicate the degree to which you agree or disagree with the following statements.

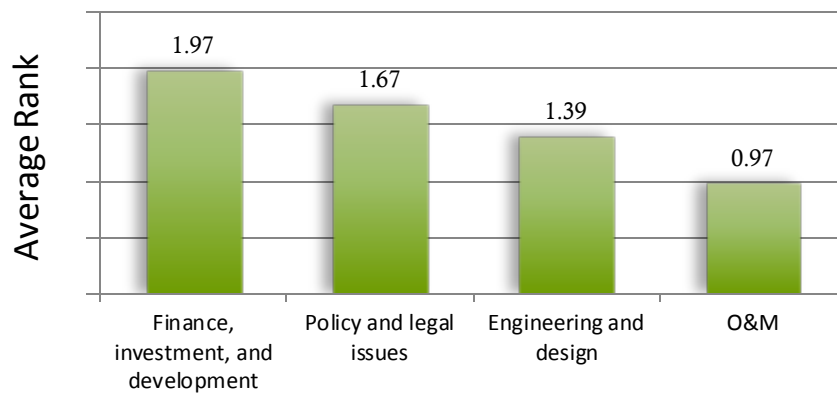


- 64% of respondents agree or strongly agree that CHP systems produce substantial efficiency improvements compared to separate central-station power and onsite boiler systems.
- 84% consider commercially available CHP technologies today to be effective and reliable.
- 79% agree or strongly agree that commercial CHP technologies can serve a wide range of electricity and thermal capacity requirements.
- 63% agree or strongly agree commercial CHP technologies can use a wide range of fuel choices.

Question 15:

RANK the following areas of Education and Training that are most urgently needed to support CHP deployment in Minnesota

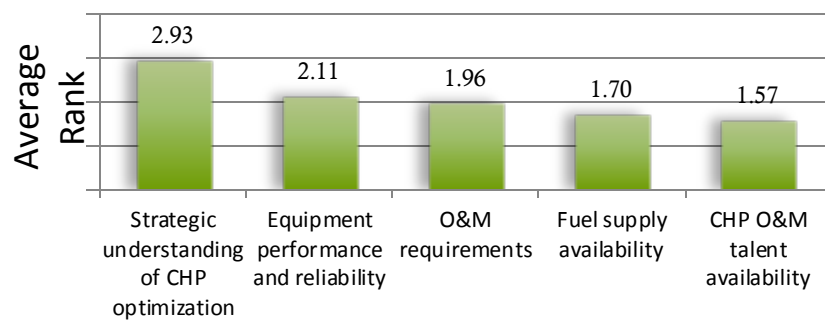
Figure 3: Average Rank out of 4



Question 16:

RANK the following technology and operational issues in terms of how substantially they hinder CHP deployment

Figure 4: Average Rank out of 5

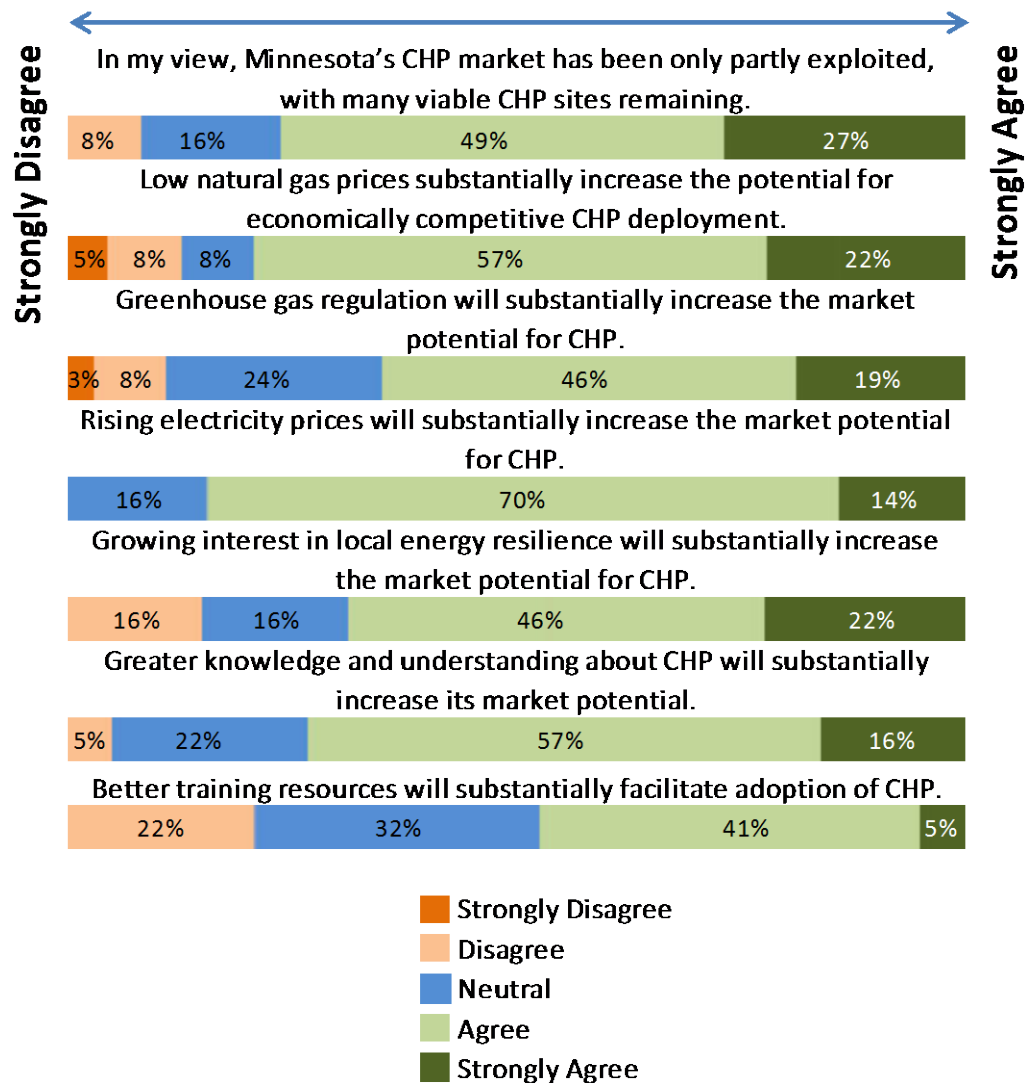


- Strategic understanding of CHP optimization as well as equipment performance and reliability were ranked as the most sizable technology and operational hindrances to CHP deployment in Minnesota.

Section 4: CHP Market Potential

Question 17:

Please indicate the degree to which you agree with the following statements as they apply to CHP in Minnesota today. (Strongly Disagree=1; Disagree=2; Neutral=3; Agree=4; Strongly Agree=5):

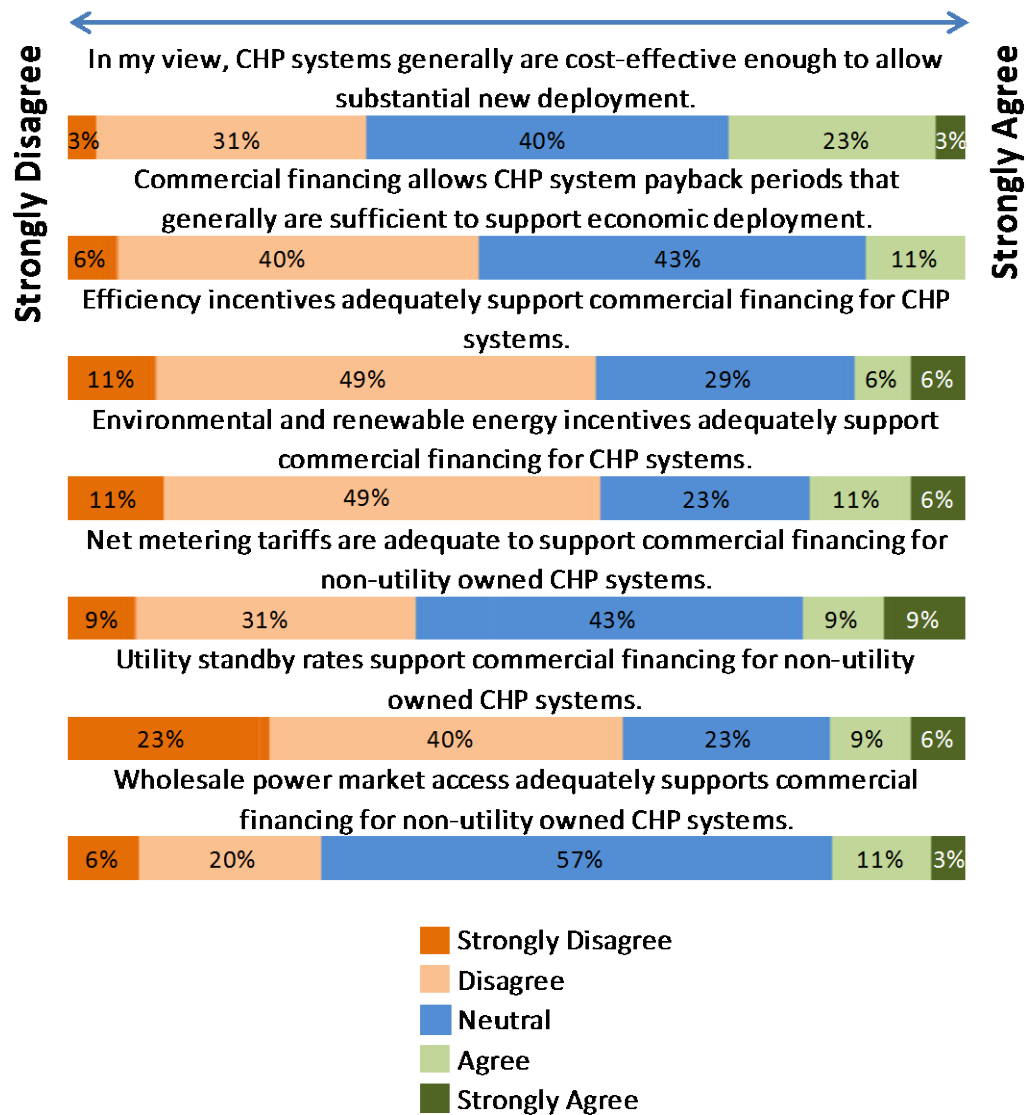


84% of respondent believe that rising electricity prices will substantially increase the market potential for CHP and 76% believe Minnesota's CHP market has been only partly exploited, with many viable CHP sites remaining.

Section 5: CHP Finance

Question 18:

Please indicate the degree to which you agree with the following statements as they apply to CHP in Minnesota today.

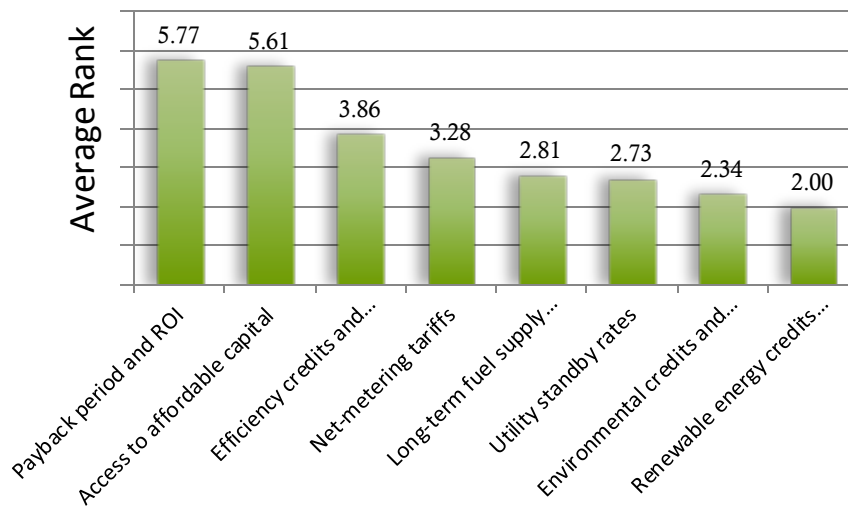


- 63% of respondents disagree that utility standby rates support commercial financing for non-utility owned CHP systems.
- 60% of respondents disagree that efficiency incentives as well as environmental and renewable energy incentives adequately support commercial financing for CHP systems.

Question 19:

RANK the following financing issues in terms of how effectively they support CHP deployment in Minnesota.

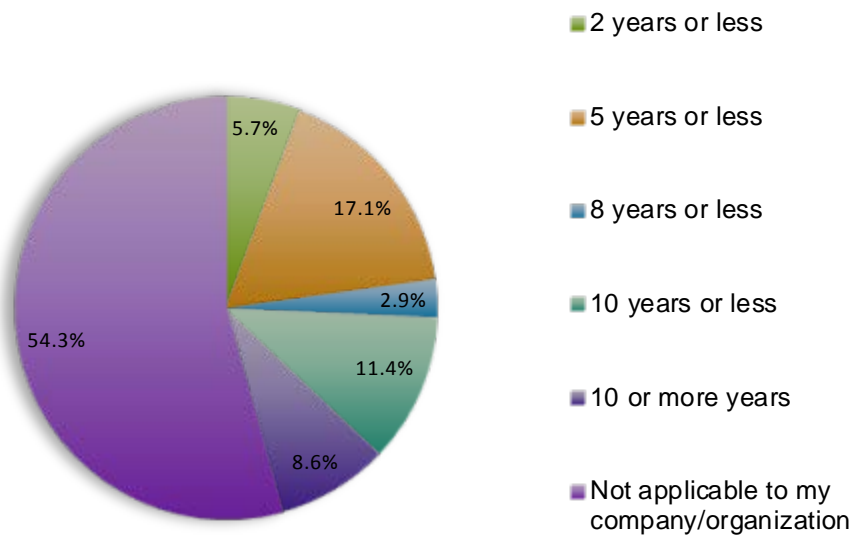
Figure 5: Average Rank out of 8



- Two thirds of respondents ranked payback period/return on investment in addition to access to affordable capital as the most important financing issues that can support CHP deployment in Minnesota.

Question 20:

For CHP or similar investments, my company/organization typically requires a simple payback period of:



- 23% of respondents require a simple payback period of 5 years or less for CHP systems.

- END OF SURVEY REPORT -

Appendix A: Weighted Average Rank Formula

Ranking questions calculate the average ranking for each answer choice to determine which answer choice was the highest ranked overall. The largest average ranking number indicates the top answer choice. When presented on a bar graph, for example, the longest bar will logically correspond with the highest ranked answer choice. The weighted ranking results are produced by the source application and cannot be adjusted by the survey administrator.

The ranking average is calculated as follows, where:

w = weight of ranked position

x = response count for answer choice

$$\frac{X_1W_1 + X_2W_2 + X_3W_3 \dots X_nW_n}{\text{Total}}$$

(Source: SurveyMonkey)

Appendix B

2014 Minnesota CHP Stakeholder Survey:

Post-Engagement Results Report

Prepared For:

Minnesota Department of Commerce - Division of Energy Resources

Prepared By:



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Prepared by:
Peter Douglass and Michael Burr
Microgrid Institute
17501 Ginger Rd.
Little Falls, MN 56345
(320) 632-5342 / mtburr@microgridinstitute.org
<http://www.microgridinstitute.org>

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Special thanks to: Jessica Burdette and Adam Zoet (Commerce); Michael Zimmer and Chris O'Brien (Microgrid Institute); and the many individuals, organizations, companies, and agencies that participated in this project.

Disclaimer

This report does not necessarily represent the view(s), opinion(s), or position(s) of the Minnesota Department of Commerce (Commerce), its employees or the State of Minnesota (State). When applicable, the State will evaluate the results of this research for inclusion in Conservation Improvement Program (CIP) portfolios and communicate its recommendations in separate document(s).

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Background and Methodology

The 2014 Minnesota Combined Heat and Power (CHP) Stakeholder Perspectives Survey seeks to gauge opinions and knowledge among a sample of people interested in CHP utilization in Minnesota and related regulatory policies and market factors. The Minnesota Department of Commerce, Division of Energy Resources (“Commerce”), commissioned the survey as the result of a grant from the U.S. Department of Energy to support stakeholder engagement in the development of a CHP action plan. This longitudinal survey was designed to assess perspectives before and after a series of CHP Stakeholder Engagement Meetings hosted by Commerce in St. Paul during September, October, and November 2014.

The initial (pre-engagement) survey questions focused on factors affecting deployment of CHP systems in Minnesota. Survey questions were divided into five categories:

1. Demographics and CHP Experience
2. CHP Policy
3. CHP Resources and Technology
4. CHP Market Potential
5. CHP Finance

The pre-engagement survey¹ was distributed on Monday, August 4, 2014 with initial notifications distributed via email to 112 recipients. Most recipients completed the survey online, with a few completing the survey by phone. By the survey’s close at 5:00 p.m. on Friday, August 15, 45 participants completed valid responses.

In part, the post-engagement meeting survey repeated questions from the pre-engagement survey, in order to measure changes in attitudes and opinions before and after the stakeholder engagement process. Additionally, the post-engagement survey sought to gauge perspectives on new topics and ideas that emerged during the stakeholder meetings. The post-engagement survey included questions divided into the same five question categories as the pre-engagement survey, with an additional category related to CHP education and training.

Microgrid Institute developed and performed this survey under the direction and review of Commerce. To support its work to develop survey questions, Microgrid Institute participated in all four CHP stakeholder engagement meetings, reviewed Commerce-commissioned reports and other industry literature, and interviewed subject matter experts on CHP markets, policy and legal issues, and finance and economics.

¹ See “CHP Pre-Engagement Stakeholder Survey Report”:
<http://mn.gov/commerce/energy/images/MG-PreEngagementSurvey.pdf>

Except for demographic questions, the post-engagement survey primarily used bounded-continuous answer formats to gauge a range of opinions and perspectives among respondents. Typical questions asked respondents to rate their agreement or disagreement with a series of statements, or asked respondents to rate a series of factors in terms of perceived importance. Microgrid Institute selected these question formats as best-practice methods to gauge respondents' perspectives, including data illustrating changes in perspectives over the course of the stakeholder meetings.

The post-engagement survey was distributed on December 9, 2014, via email to 218 recipients, with 112 of these comprised of the pre-engagement survey sample and an additional 75 stakeholders identified through the meetings. All responses were collected online. The survey closed at 5:00 p.m. on January 2, 2015, having received 46 valid completed responses. Of these, 41 percent also responded to the pre-engagement survey.

Survey Sample

The sample for the CHP Stakeholder post-engagement survey was comprised of individuals and organizational representatives that Commerce and Microgrid Institute identified in the pre-engagement survey sample as well as those who attended one or more of the stakeholder meetings. Among respondents, about 93 percent reported attending at least one of the four stakeholder meetings, with 36 percent attending all four. Post-engagement survey respondents' reported organizational affiliations are summarized as follows:

Organization Type	% of Responses
Utility	33
Advocacy groups	15
Consulting/legal/finance	15
Government	9
Institutional/ commercial	9
Industrial	7
Independent power producer	4
Other	8
TOTAL	100

Survey respondents were self-selected – meaning, they opted in to respond to the survey, and Microgrid Institute had limited control over demographic distribution of

responses from among the stakeholder sample. Additionally, the survey required respondents to provide valid contact information to determine whether A) they were among the sample group and B) they would participate in separate interviews on the survey subject. The survey assured respondents that their answers would be treated confidentially by Microgrid Institute and Commerce, and that survey results would be reported only in aggregate form.

Microgrid Institute conducted follow up emails and telephone notifications to increase survey response rates.

Findings and Analysis

Post-engagement survey responses reflect a wide range of knowledge, experience, and opinions related to CHP operations, markets, policies, and economics in Minnesota. The survey results for each of these major areas are summarized below.

CHP Experience, Technology and Operations: In general, respondents hold positive views toward CHP technologies, with substantial majorities agreeing that CHP technologies today:

- are effective and reliable (75 percent agree or strongly agree);
- produce substantial efficiency improvements (67 percent agree or strongly agree);
- can use a wide range of fuels (80 percent agree or strongly agree); and
- can serve a wide range of customer requirements (74 percent agree or strongly agree).

CHP Policy: Responses regarding CHP policies indicate a mix of perspectives, with generally more responses indicating that current energy policies and regulatory frameworks tend to impede CHP deployment in Minnesota.

Almost half (46 percent) of respondents agreed or strongly agreed with the statement that standby power tariffs are fair and non-discriminatory toward CHP systems owned by customers and third parties in Minnesota. In contrast, 39 percent of respondents disagreed or strongly disagreed with the same statement, while 15 percent neither agreed nor disagreed.²

46 percent of respondents ranked utility business interests and strategic conflicts as the most important hindrances to CHP deployment in Minnesota by utilities, with permitting and licensing showing the least hindrance. Uncertainties about applying CHP

² Totals exceeding 100 percent reflect aggregated responses indicating agreement and strong agreement.

toward utility Conservation Improvement Program (CIP) goals were identified as the second-most important hindrance to CHP deployment by utilities (43 percent of respondents), followed closely by uncertainty about rate-base treatment for CHP assets (42 percent).

In regard to CHP deployment by customers and third parties, 46 percent ranked standby power rates as the most important hindrance, with 39 percent ranking utility business conflicts as most important; with inadequate policy incentives following (30 percent).

Market Potential: With a rating average of 3.4 (on a scale of 1 to 6, with 6 being the best), respondents indicated that examining CHP potential of public facilities would be the most useful mapping initiative to help facilitate CHP deployment in the state. Examining the potential of heat recovery additions at existing generation facilities and studying economic development needs and opportunities both ranked second with rating averages of 2.6.

CHP Economics: Respondents indicated significant doubt about the economics of CHP under current market and policy conditions. 71 percent of respondents disagreed or strongly disagreed that commercial financing allows CHP system payback periods sufficient to support economic deployment. In addition, 68 percent disagreed that environmental and renewable energy incentives adequately support commercial financing for CHP systems while 61 percent disagreed that efficiency incentives also support it.

When evaluating CHP projects, 85 percent of respondents identified cost effectiveness as the most significant criteria. This includes energy cost savings potential, energy efficiency, spark spread, investment returns and risk-reward factors. 73 percent rated customer criteria including demand for CHP outputs, local fuel production capabilities and constraints and resilience factors as the second most important.

Education and Training Needs: Respondents indicated that case studies (46 percent) and site tours (46 percent) followed by technical school courses (45 percent) were most useful education resources needed to help facilitate CHP deployment in the state. Only about one-third of respondents agreed that Minnesota colleges and universities provide adequate technical training to produce qualified CHP operation and maintenance professionals.

Longitudinal Analysis

While responses in the pre-engagement and post-engagement surveys indicated no major trends in shifting perspectives, some longitudinal variances³ were observed.

Demographics: The proportion of respondents identifying themselves as utility representatives increased from 26 percent to almost 33 percent.

CHP Experience, Technology and Operations: There was a decline (from 84 to 75 percent) in the number of respondents who agree or strongly agree that commercially available CHP technologies today to be effective and reliable, while those who believe that commercial CHP technologies can use a wide range of fuel choices increased from 63 to 80 percent.

CHP Policy: For policy issues, in terms of how substantially various policy factors hinder CHP deployment by utilities in Minnesota, respondents consistently placed utility strategic conflicts or business interests along with uncertainty about applying CHP toward meeting utilities' CIP goals among the most important issues. These were followed respectively by uncertainty about rate-base treatment for CHP assets and a utility's inability to monetize system-wide values for CHP assets, both of which ranked as important hindrances in both surveys.

Between the pre- and post-engagement surveys, standby power rates went from ranking third to first as a policy issue hindering CHP deployment by customers and third parties in Minnesota. Utility strategic conflicts, ranked first in the pre-engagement survey, moved to second, while inadequate policy incentives shifted from second to third in the post-engagement survey. Overall, responses consistently identify these factors as the three most important hindrances to customer/third-party CHP development. Moreover, respondents in the post-engagement survey selected transparent and fair standby rate policies as the most effective policy initiative (43 percent ranked among top three choices).

At the same time, however, respondents increased their estimation of the fairness of standby power tariffs toward customer/third-party-owned CHP; 19 percent of respondents in the pre-engagement survey agreed or strongly agreed that standby rate policies are fair and nondiscriminatory, while 46 percent agreed with the statement in the post-engagement survey. This major variance is attributable to a decline in those

³ Longitudinal analysis compares and contrasts all response results between the pre- and post-engagement stakeholder surveys. Comparing responses of only the 41 percent of post-survey respondents who completed the pre-engagement survey produces an inadequate sample for meaningful comparative analysis.

who either disagreed or neither agreed or disagreed with the statement (a decline from 73 percent pre-engagement to 57 percent post-engagement).

This is a significant change in perspectives, but its significance is unclear given its juxtaposition with respondents' rising estimation of standby rates as a policy hindrance. Comparatively, respondents also increased their estimation of the fairness of utility interconnection policies (44 percent judged them to be fair and non-discriminatory in the post-engagement survey, vs. 30 percent pre-engagement) and net-metering tariffs (up to 40 percent from 19 percent). These changes may be attributable, in part, to the information presented in the stakeholder meetings. It also may correlate with the increase in respondents representing utilities in the post-survey.

Market Potential: Those who disagree or strongly disagreed that commercial financing allows CHP system payback periods sufficient to support economic deployment rose from 46 to 71 percent, pre- and post-engagement, respectively. Conversely, the number of respondents who agreed or strongly agreed with the view that CHP systems are cost-effective enough to allow substantial new deployment rose from 26 to 32 percent. These changes may reflect stakeholders' improved understanding that CHP can be cost-effective, but that project investments require low-cost financing that can be difficult to obtain.

Conclusion and Next Steps

To the degree the State of Minnesota determines that CHP represents a potential solution to achieve the state's energy goals, Minnesota policies should, at a minimum, treat CHP in a fair and nondiscriminatory manner, and regulatory frameworks should avoid discouraging or preventing CHP deployment – either by utilities or customers and third parties.

The post-engagement meeting survey results suggest that respondents believe the following are among the most important initiatives⁴ the State could implement to facilitate CHP deployment:

1. Introduce transparent, unbundled pricing for standby rates (43 percent)
2. Establish CHP project evaluation methodologies and criteria (39 percent)
3. Include CHP as a supply-side opportunity in the Electric Utility Infrastructure program under CIP (38 percent)

⁴ *i.e.*, They ranked these issues among the three most effective policy initiatives to facilitate CHP deployment in Minnesota.

Respondents' #1 rating of standby rate transparency reflects stakeholders' expressed interest during CHP stakeholder engagement process in ensuring standby rate policies are effective and fair. Likewise, stakeholders' survey responses are consistent with their expressed interest in proposed initiatives to establish standard CHP project evaluation methodologies and CIP EUI provisions for CHP.

Results from the pre- and post-engagement CHP stakeholder surveys will support Minnesota's ongoing efforts to evaluate options and develop a CHP Action Plan.

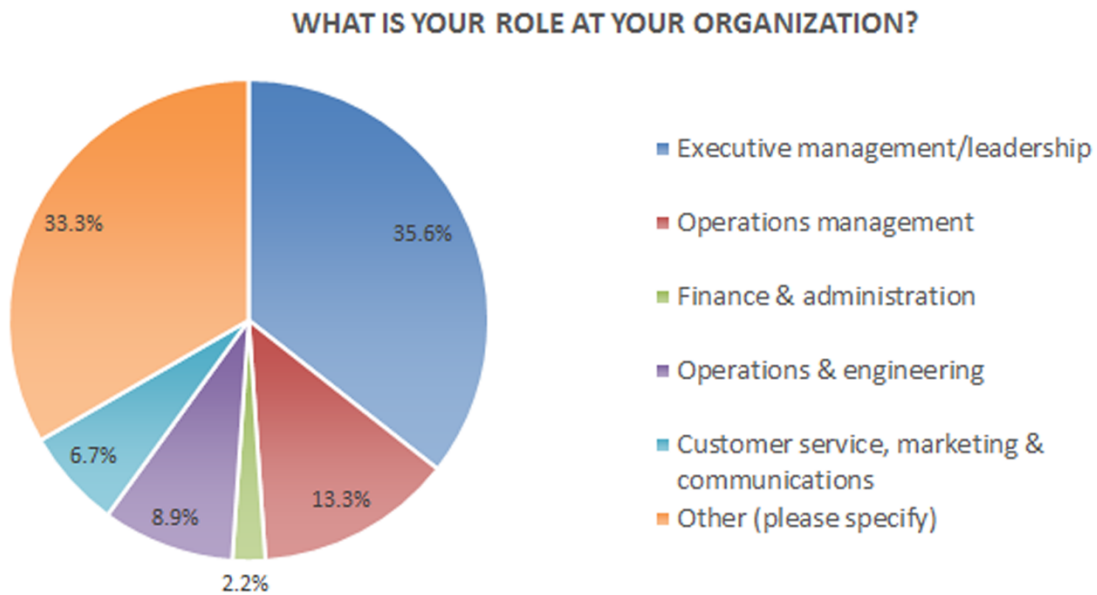
Questions about either the pre-engagement, or post-engagement survey and related reports should be directed to Microgrid Institute:

- Peter Douglass (pdouglass@microgridinstitute.org / 320-493-1923)
- Michael Burr (mtburr@microgridinstitute.org / 320-632-5342)

2014 Minnesota CHP Stakeholder Survey: Post-Engagement Results

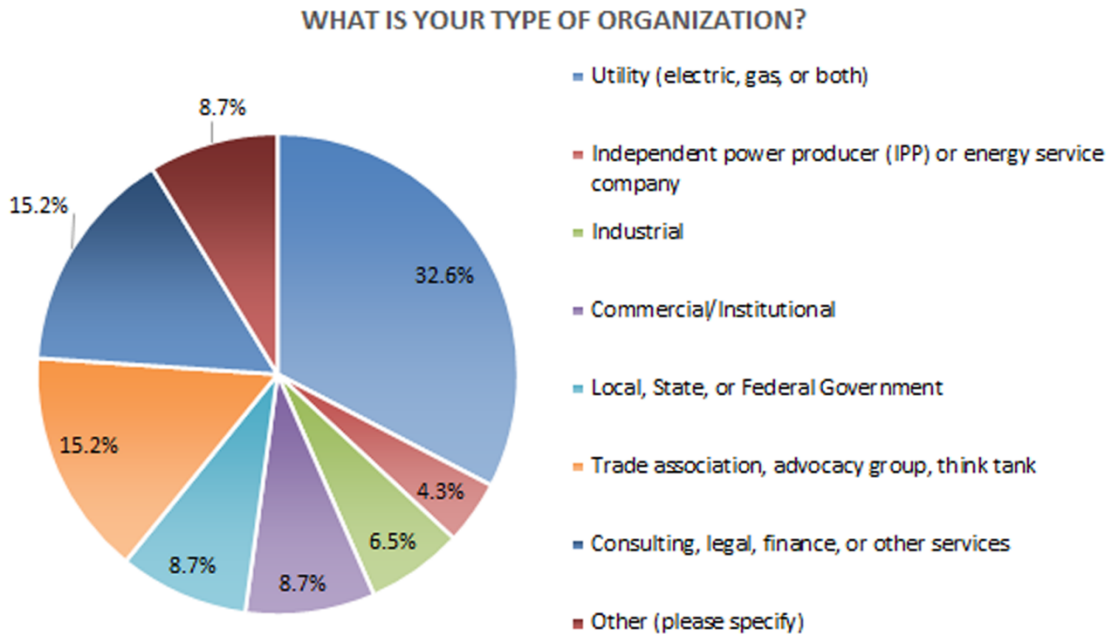
Section 1: Demographics

1. What is your role at your organization?



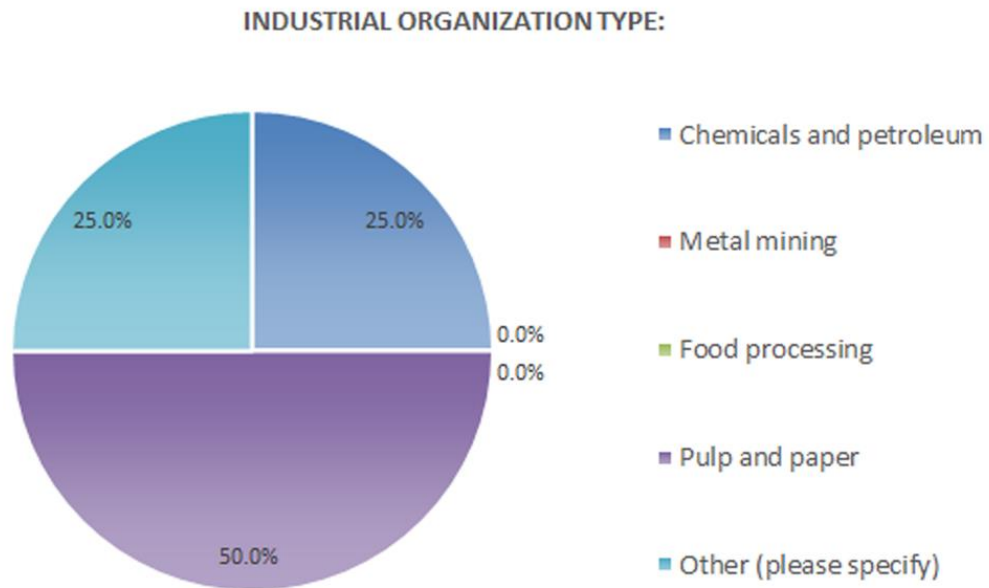
Most attendees (36%) held executive management or leadership roles at their organization. The "Other" category comprised mostly of regulatory and policy related positions followed by planning positions and consultants.

2. What is your type of organization?

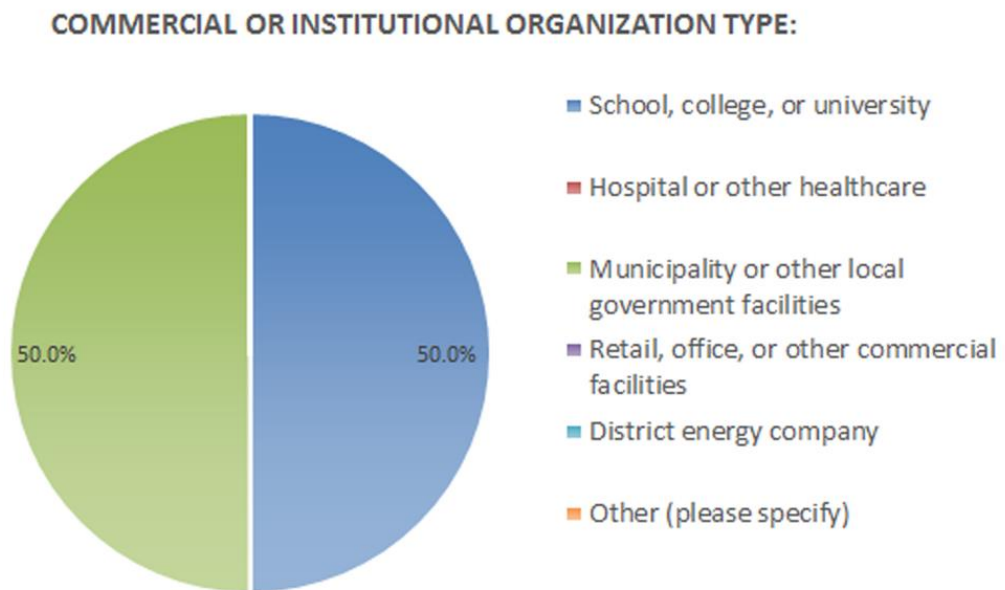


Most (33%) attendees held positions at utilities (gas and electric) with consulting and advocacy groups following at 15% respectively.

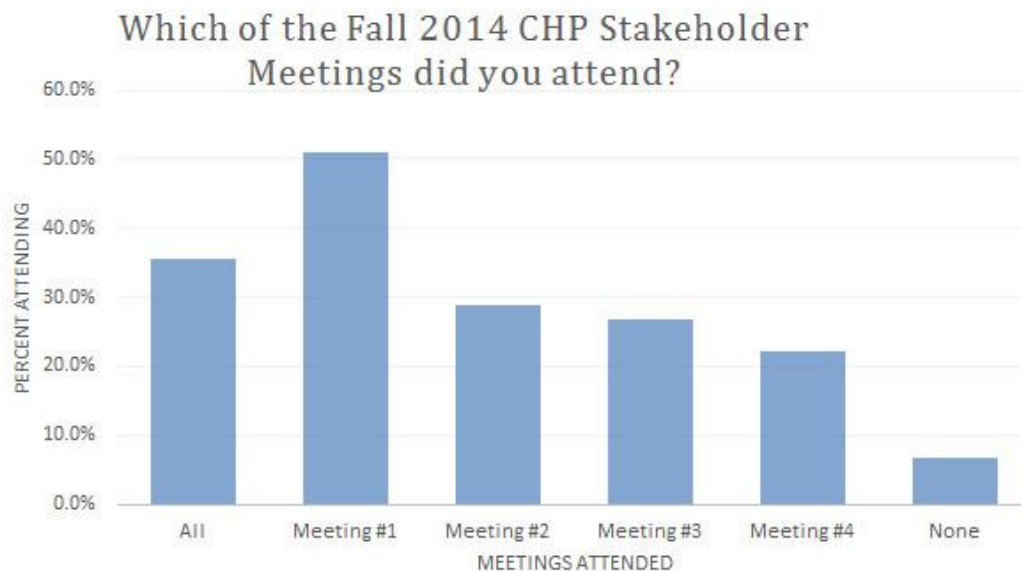
3. Industrial organization type:



4. Commercial or Institutional organization type:



5. Which of the fall 2014 CHP Stakeholder Meetings did you attend?



6. When you attended the CHP stakeholder meetings, were you seeking a specific solution to a business need or problem?

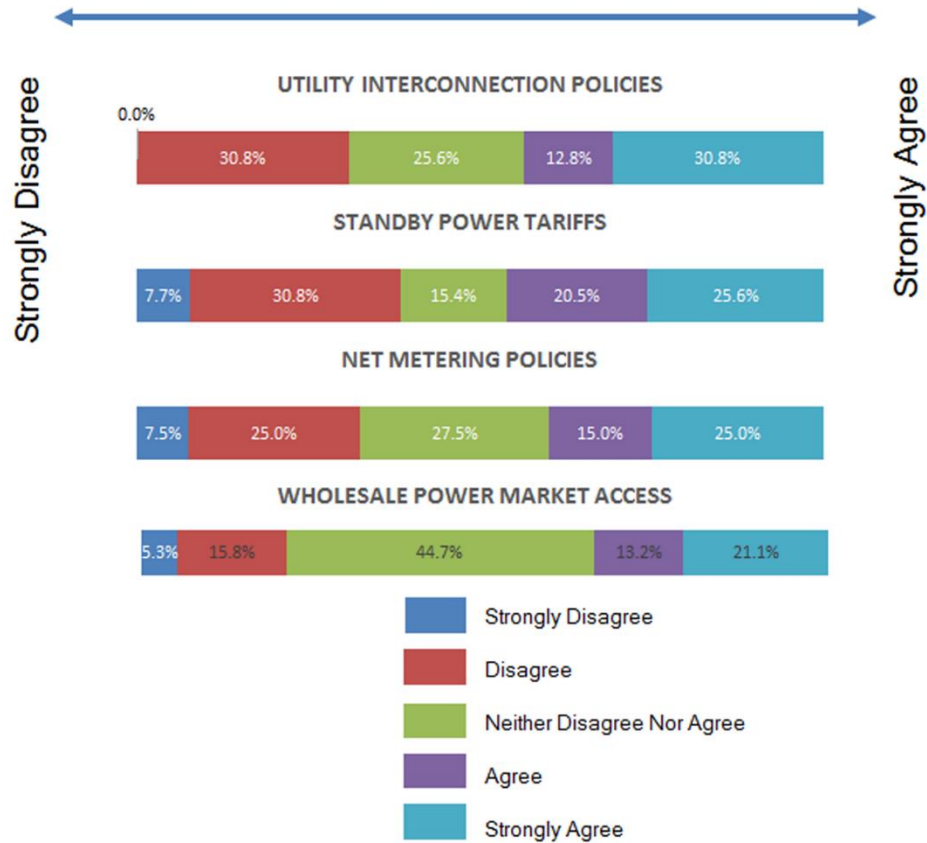
If you responded "Yes," what was that need?

1. Address barriers to CHP in Minnesota. Learn more about how CHP might be integrated into existing or new MN policy
2. Broaden acceptance of CHP.
3. Gaining understanding of possible legislation. Learning about potential, costs, and benefits of CHP.
4. Guidance on funding support and key metrics for planning, evaluating and completing a CHP project
5. Ideas to overcome obstacles to building a CHP
6. In part looking for how funding mechanisms and policies impact implementation/operation of a CHP facility fueled from biogas produced from the wastewater treatment process.
7. Information as to regulation and policies in regards to ownership and standby rates in regards to our combined heat and power project that we have planned.
8. Interested in the prospect of state funding/matching grants for CH&P systems.
9. Lack of consumer and producer incentives as well as prohibitive utility policies for increasing the proliferation of combined heat and power systems
10. My interest was learning of CHP as a possible solution to smaller communities reliant on propane.

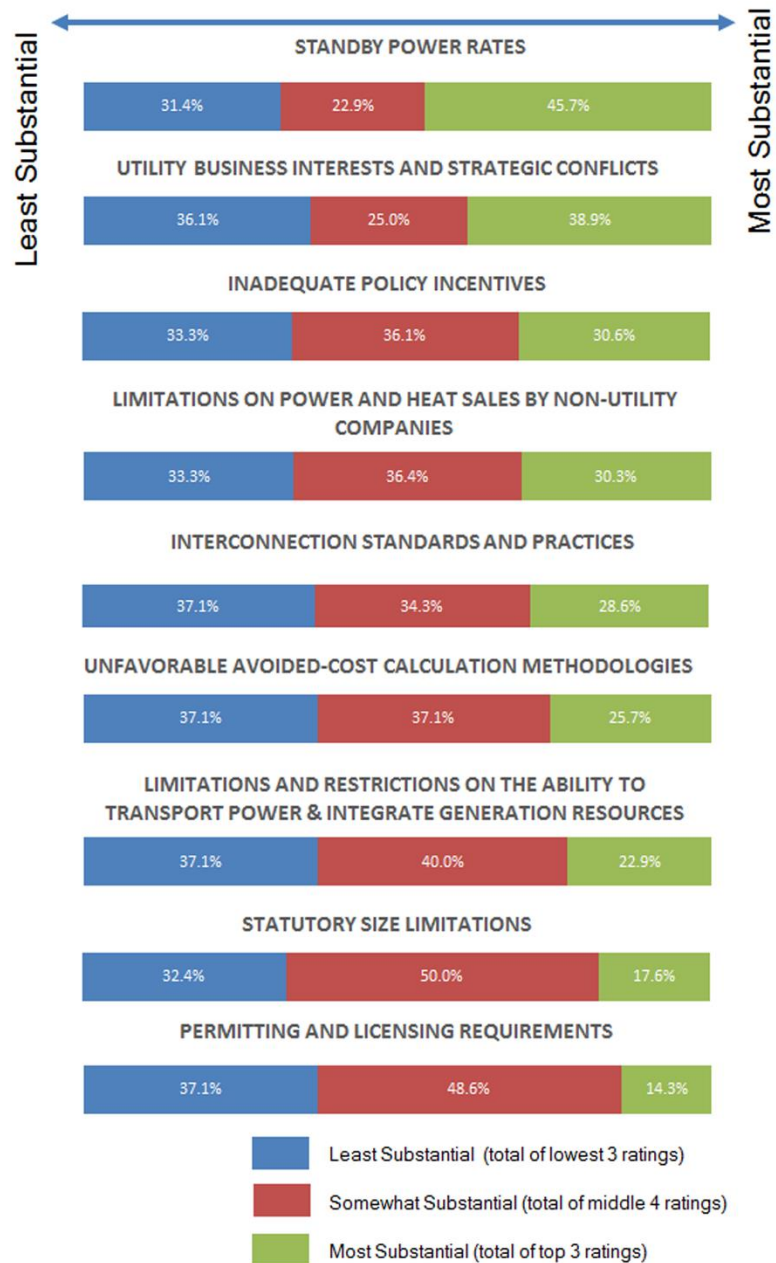
11. *Opportunities for CHP to be credited in the State of Minnesota through existing or new utility programs.*
12. *Primary purpose was to gain knowledge of the subject matter and the overall process.*
13. *Project implementation issues. Standby costs.*
14. *Pursuing regulatory reform to support cost recovery for utility-owned CHP projects.*
15. *State review of unwarranted standby rates and other barriers to CHP & WHP deployment in MN; Inclusion of CHP and WHP in MN CIP or alternative energy incentive programs; Structuring of state and utility programs to most effectively incentivize CHP & WHP project development.*
16. *To gain an understanding of all stakeholder perspectives, ideas, concerns; to get an introduction to the overall DOC process*
17. *We were looking for a deeper understanding of how CHP could benefit large industrial users. Also, to understand the technology capabilities.*
18. *We were seeking information, analysis, and policy options on pathways Minnesota could pursue to remove regulatory and market barriers to CHP in the state, and opportunities to create incentives for greater deployment of CHP in the state.*
19. *We plan to install bio-gas fueled engine generators to supply electricity and heat for our processes.*

Section 2: CHP Policy

7. Please indicate the degree to which you agree or disagree that each of the following policies is fair and nondiscriminatory towards customer- and/or third-party-owned CHP systems in Minnesota.



8. On a scale of 1-10 please rate the following policy issues in terms of how substantially they hinder CHP deployment by customers and third parties in Minnesota. (With 10 being the most substantial and 1 being the least substantial)



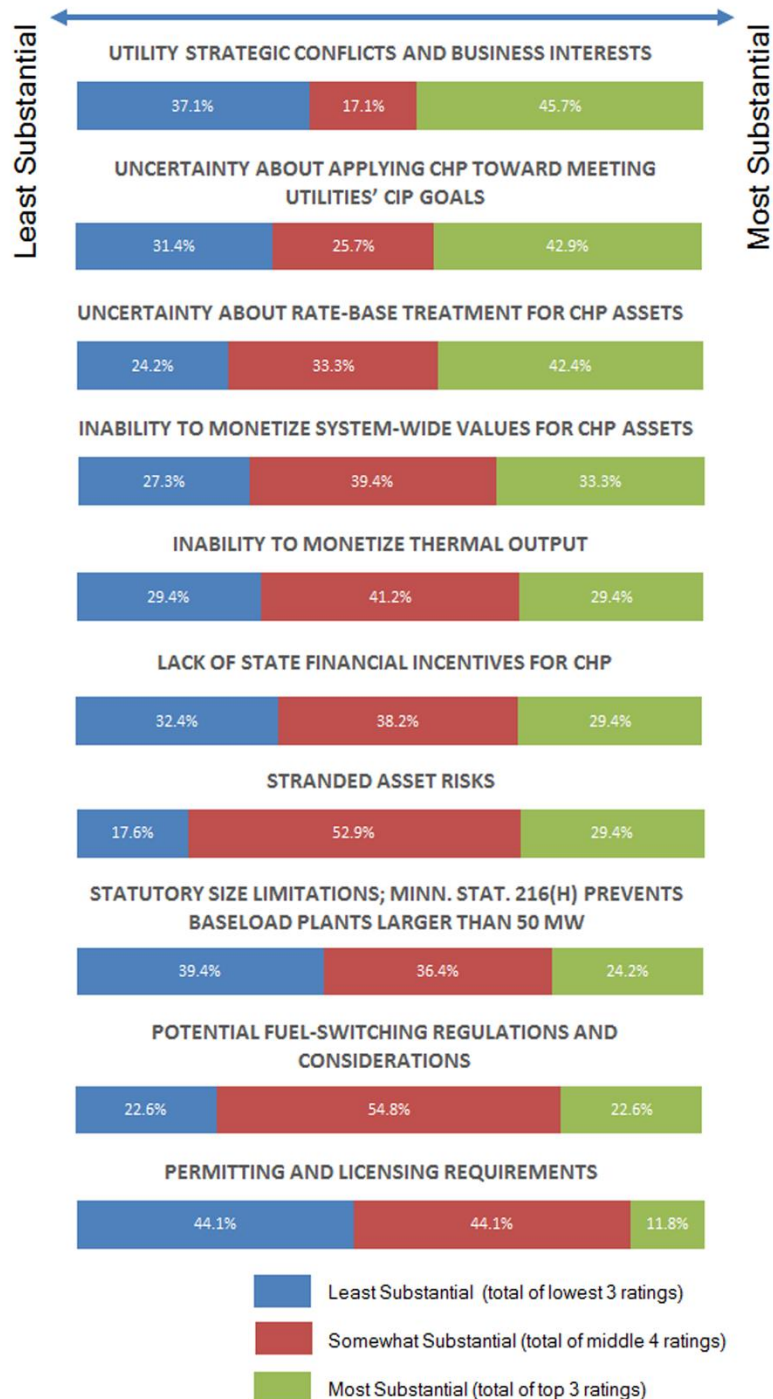
Other Comments:

1. Lack of project finance
2. Low utility "avoided cost" calculations
3. Market Potential and low avoided costs are the largest barriers
4. Project economics

5. *The biggest obstacle is that in most instances, it doesn't make financial sense for customers or third parties to invest in CHP.*
6. *Transparency of standby rates and interconnection costs*

Continued on next page

9. On a scale of 1-10 please rate the following policy issues in terms of how substantially they hinder CHP deployment by utilities in Minnesota. (With 10 being the most substantial and 1 being the least substantial)

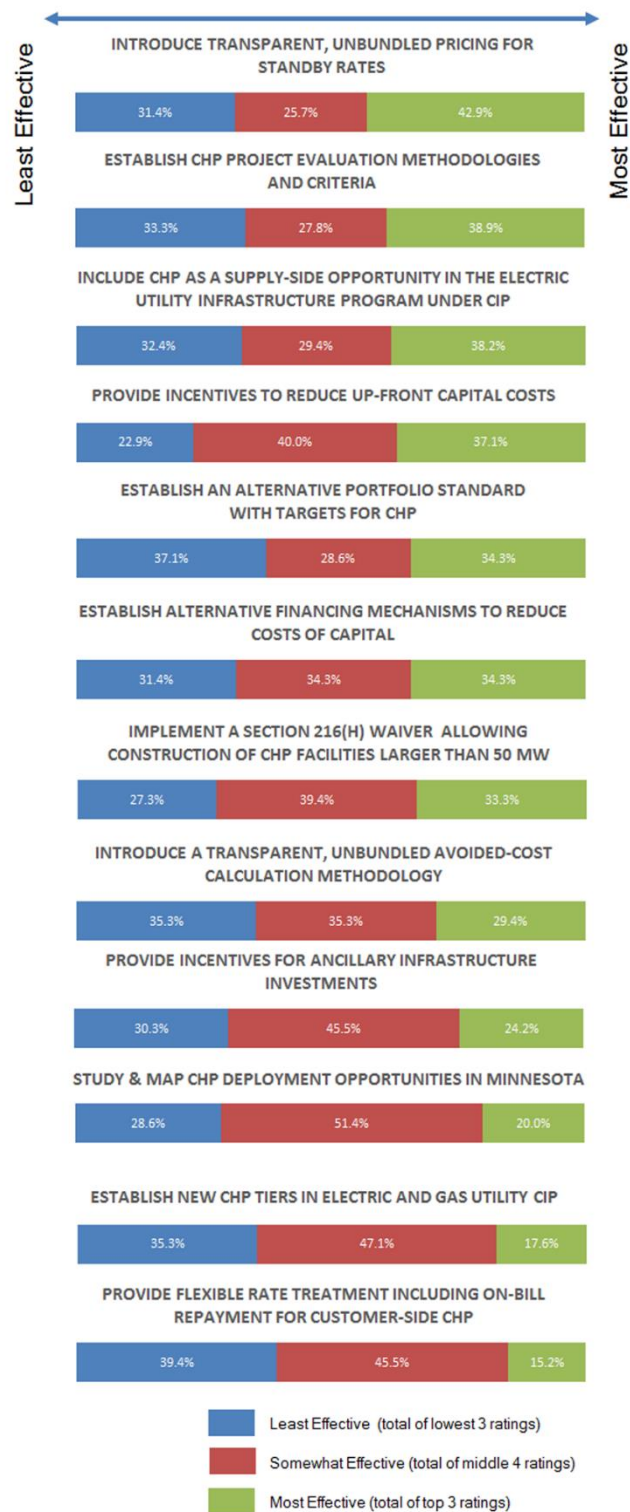


Other Comments:

1. *Complexity of multi-party partnerships*

Continued on next page

10. On a scale of 1-10, please rate the following initiatives the state could consider implementing to help facilitate CHP deployment in Minnesota. (With 10 being the most effective and 1 being the least effective)

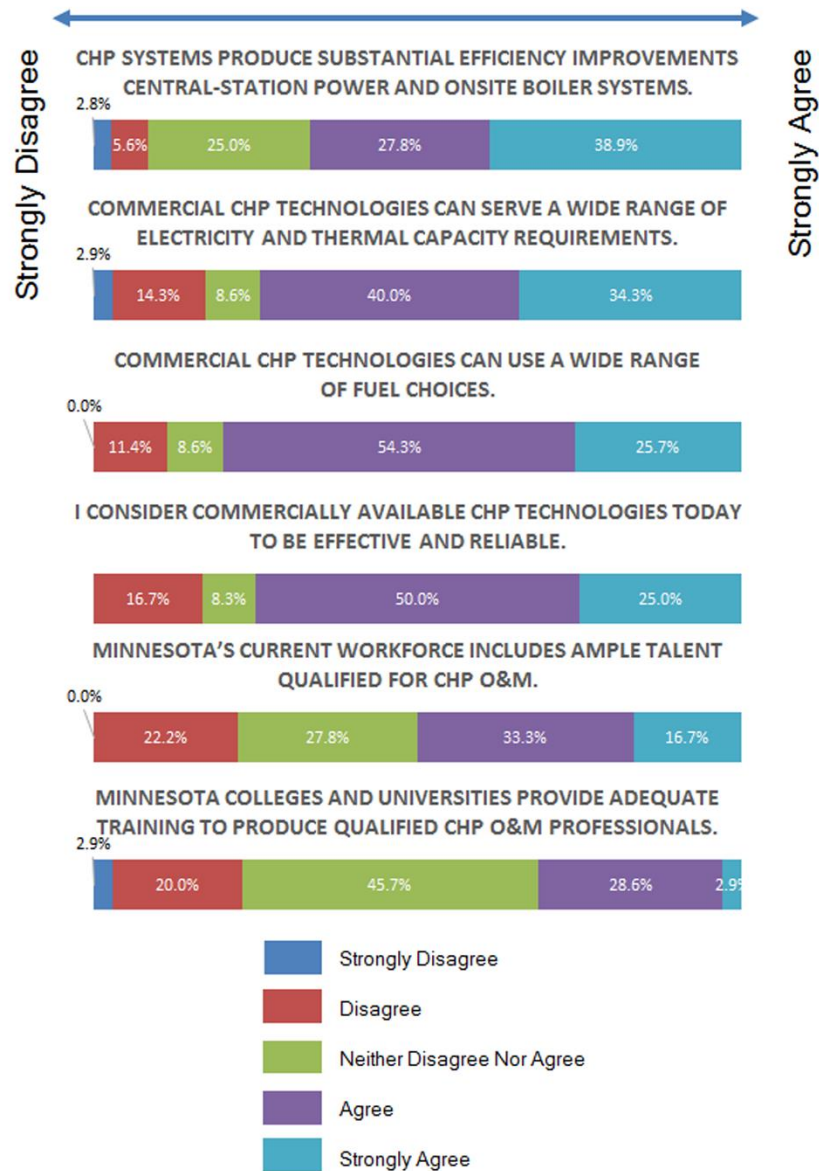


Other Comments:

1. ANY Utility Owned/Operated DG should be allowed to be rate-based.
2. Require consideration of CHP in IRP

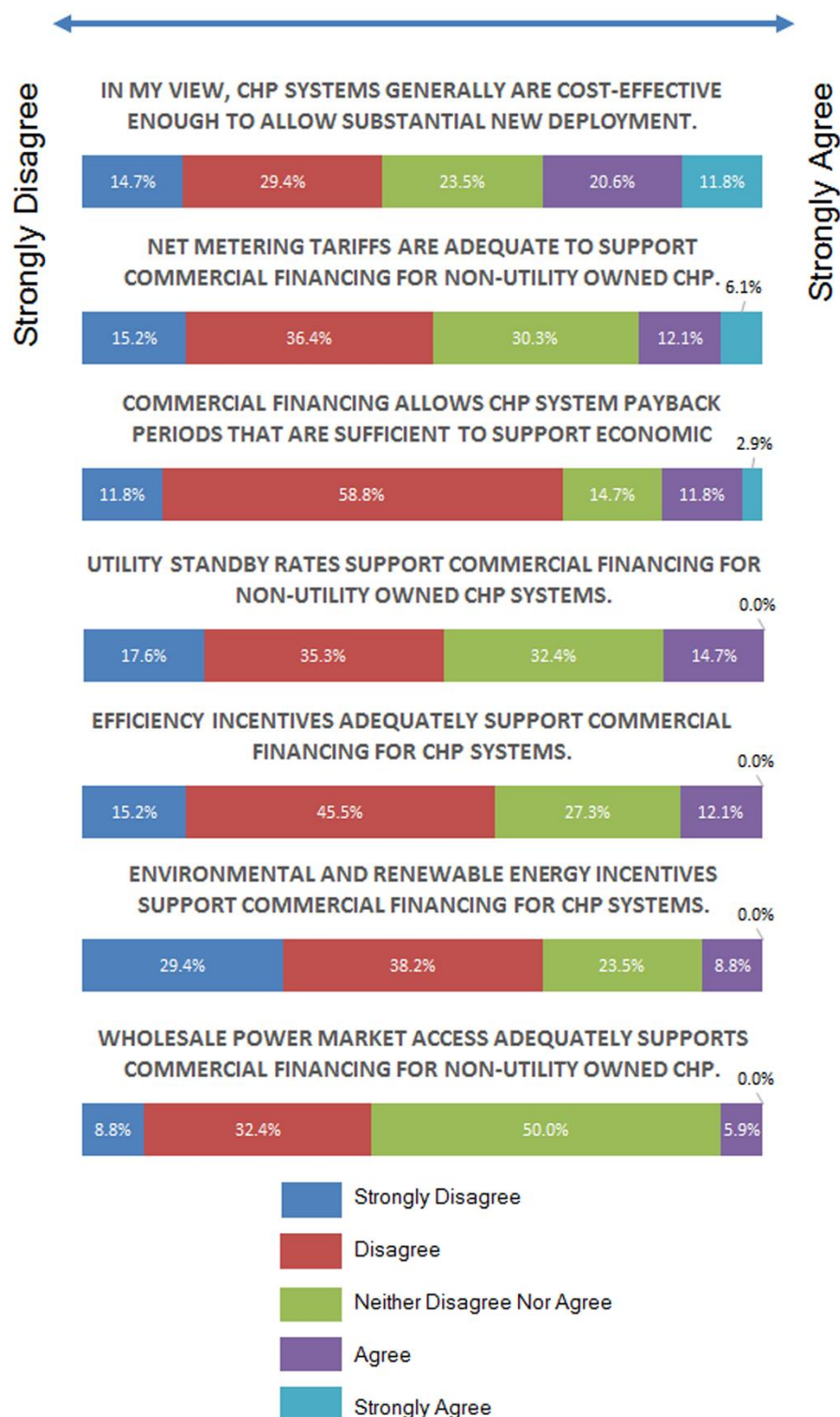
Section 3: CHP Resources and Technology

11. Please indicate the degree to which you agree or disagree with the following statements.

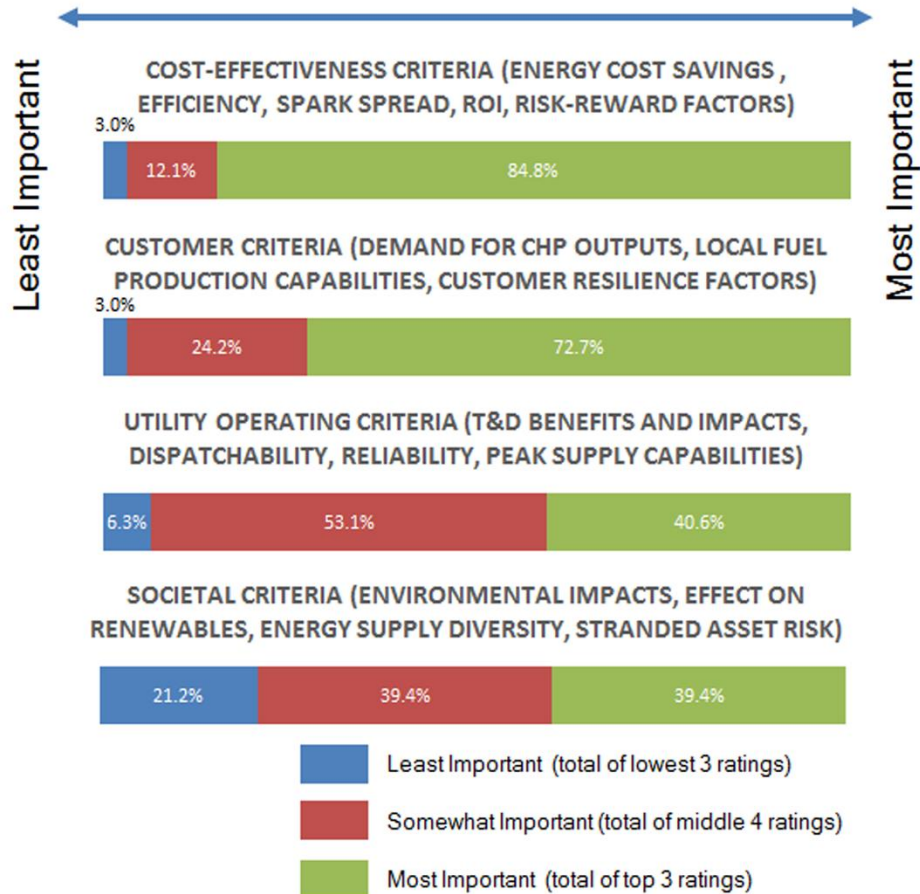


Section 4: CHP Financing

12. Please indicate the degree to which you agree with the following statements as they apply to CHP in Minnesota today.



13. In terms of their importance, please rate each of the following categories of criteria for ensuring CHP projects are evaluated appropriately (1=least important, 10 = most important).



Other Comments:

1. Each of these criteria has different levels of importance in different regulatory and market contexts. So while all of them are relatively very important, each of them carry more weight depending on the context in which CHP projects are being evaluated.

Section 5: CHP Market Potential

- 14. Rank the following CHP mapping initiatives that would be most useful and effective to facilitate CHP deployment in Minnesota. (Rank with 5 being the most useful and 1 least useful):**



- 15. What specific areas of CHP development would you be interested in learning more about?**

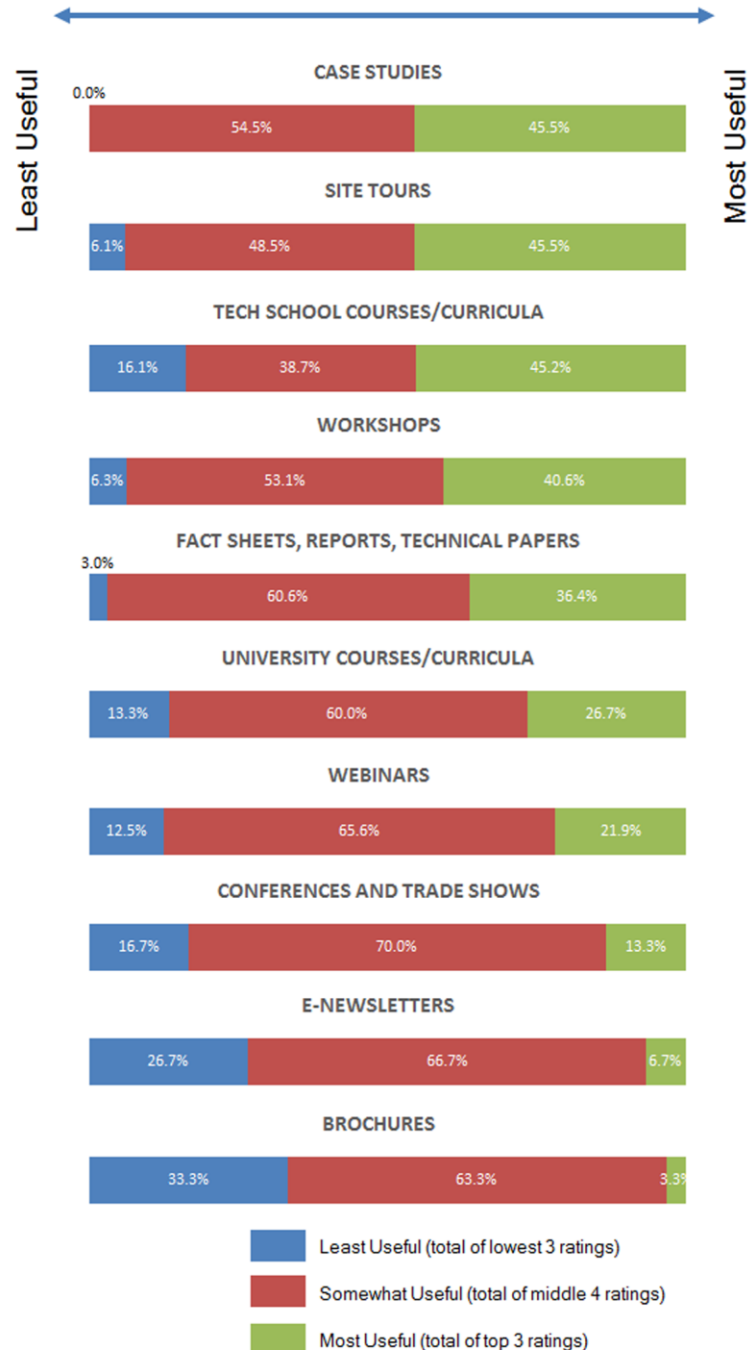
- 1. Any and all! Especially: Economic evaluation criteria and methodology, advances in CHP technologies; integration of CHP into the "smart grid"*
- 2. Legislative initiatives*
- 3. Look at locating thermal load where existing generation exists that could be transitioned to CHP, or installing pipelines to take recovered heat to where it can be used. Don't limit to just examining public facility CHP potential. Can be broadened. Examine where CHP already exists, is it possible to increase the thermal load to increase cogenerated electricity, or expand the use of CHP. Redevelopment opportunities, including brownfields, are locations where thermal load can be aggregated to support CHP.*

4. *Opportunities for CHP deployment at MN ethanol/biofuels plants; Opportunities for CHP deployment at MN WWTPs; Moderated roundtable discussions with utilities, CHP developers and end-users to discuss perceived issues*
5. *Renewable Based and best available technology.*
6. *Renewable fuel CHP sources and applications.*
7. *Rural manufacturing development potential of CHP in economic development packages.*
8. *Wastewater Treatment*

Continued on next page

Section 6: CHP Education and Training

16. In terms of usefulness please rate the following education, training, and information resources needed to support CHP deployment? (With 10 being the most useful and 1 being least useful)



Other Comments:

1. *Robust state and utility website CHP & WHP pages describing available financing programs and incentives*

17. Are you willing to take part in a separate interview on these topics?

71% of respondents indicated they would be willing to take part in a separate interview on CHP while 29% said they would not.

18. Use this portion for any additional comments:

1. *Answers provided are supported by the NSPM CHP Market Potential Study conducted by EPRI this fall and filed with our comments to the MN DOC in October 2014. Unanswered questions are deemed inconsistent with the intent of the utility's regulatory compact.*
2. *CHP is a fascinating technology which includes many benefits. Unfortunately this technology's application has economic potential in very few areas. While the technology does have its merits it does not fit within CIP as a demand side resource. With very limited economic potential opportunities, it seems using a "stick" and requiring new standards or mandates could penalize certain areas of the State. Any use of ratepayer or taxpayer funds for economic development should be used in all corners of the state. The best CHP opportunities may exist at current generating sites.*
3. *Great job! The fall meetings were well run and comprehensive. Many thanks to the Department for providing this forum and the focus on CHP and WHP program options. We look forward to seeing the Action Plan. Happy holidays!*
4. *I know enough to be dangerous about CHP, but I am confident distributed CHP facilities would enhance resiliency and remove market volatility by reducing reliance on propane (specific to rural communities).*
5. *My personal opinion is that customer/3rd-Party owned/operated CHP (or DG in general) must not be allowed to generate more electricity than can be consumed "behind the meter" - at least not yet. Distribution Grids, as they currently exist, were planned, designed and constructed for one-way electricity flow. It would be pre-mature to assume that utilities have the resources, today, to be capable of making significant Grid upgrades and/or plan, design, construct new Grids capable of supporting a "dynamically evolving" energy system. I believe a thoughtful, mutually agreed to, "staged" approach will help both customers and utilities develop the Grid of the Future.*
6. *Sure, but our background in implementation is quite limited.*
7. *The keys to CHP development in Minnesota are: (1) Remove 216H restriction (2) Establish a mechanism whereby an entity can "buy space" (\$ per Megawatt per mile) on the transmission grid to allow CHP producers to generate their own electricity, transport it across the grid, and use it to displace retail purchased electricity. This type of structure would radically improve the economics of CHP's. The mechanism would be similar to tariffs charged on a common carrier pipeline.*
8. *The line of questioning within this survey seems to be operating under the assumption that CHP facilities inherently generate value for end use customers and non-CHP participants due to the value that is provided to the grid. The current economic picture with respect to CHP does not necessarily lead to this conclusion. For utilities that have no*

need for new generation resources CHP does not represent a benefit to their end use consumers. The discussions around incentives and policy treatment are geared towards trying to ensure that these types of systems will be developed, which can occur if the incentives and favorable treatment are great enough. But an incentive based rationale for major investments such as CHP has not played out favorably in past development scenarios such as renewable energy development. The approach to CHP development must rely on a need based approach.

- 9. Third party investors will be the single most influential driver behind any CHP deployment. Therefore, CHP will only reach its deployment potential with adequate incentives for those investors. By way of example, the federal 1603 tax credit program stimulated significant CHP development nationwide, but was not renewed.*
- 10. This is not my expertise nor do I have any background in CHP projects or potential.*
- 11. Two concerns: Renewable energy opportunities and Carbon free generation. It is not addressed in any CHP discussions.*

- END OF SURVEY REPORT -

Appendix A: Weighted Average Rank Formula

Ranking questions calculate the average ranking for each answer choice to determine which answer choice was the highest ranked overall. The largest average ranking number indicates the top answer choice. When presented on a bar graph, for example, the longest bar will logically correspond with the highest ranked answer choice. The weighted ranking results are produced by the source application and cannot be adjusted by the survey administrator.

The ranking average is calculated as follows, where:

w = weight of ranked position

x = response count for answer choice

$$\frac{X_1W_1 + X_2W_2 + X_3W_3 \dots X_nW_n}{\text{Total}}$$

(Source: SurveyMonkey)

Appendix C:
Survey Response Data

[Please see separate XLS files containing raw survey response data from pre- and post-engagement CHP stakeholder surveys.]

Appendix D

CHP Stakeholder Comments

Comment Period: Sept. 24 through Oct. 10, 2014

Final Summary Report Prepared For:

Minnesota Department of Commerce - Division of Energy Resources

Prepared By:



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Background

As part of the 2014 Minnesota CHP Stakeholder Engagement process, the Minnesota Department of Commerce, Division of Energy Resources, arranged a comment period from Sept. 24 through Oct. 10, 2014.¹ Commerce invited stakeholders to submit written comments on issues involving CHP in Minnesota, and specifically on the following:

- FVB Energy's proposed CHP policy options
- CHP finance, policy, technical application, and education and training needs
- Alternative mechanisms and approaches to facilitate economically efficient deployment of CHP in Minnesota
- Current barriers and issues hindering CHP projects
- Resource planning, strategic, and regulatory factors affecting CHP options and potential
- Any other CHP issues on which stakeholders would like to comment

Commerce received submissions² from the following stakeholder organizations:

[BlueGreen Alliance](#)

[CenterPoint Energy](#)

[Cummins Power Generation](#)

[Fresh Energy](#)

[Great Plains Institute](#)

[Great River Energy](#)

[Midwest Cogeneration Association](#)

[Minnesota Chamber of Commerce](#)

[Minnesota Power](#)

[Otter Tail Power](#)

[Vergent Power Solutions](#)

[Western Lake Superior Sanitary District](#)

[Xcel Energy](#)

¹ Commerce scheduled the comment period to coincide with the three weeks separating CHP Stakeholder Meetings #2 (Sept. 3, 2014) and #3 (Sept. 24, 2014); see Appendix A and Commerce Website. <http://mn.gov/commerce/energy/businesses/clean-energy/distributed-generation/2014-workshops/chp-meetings.jsp>

² Commerce received 11 comment submissions by Oct. 10, 2014, the official expiration of the comment period, and also accepted two (2) submissions in subsequent days from the Midwest Cogeneration Association and Vergent Power Solutions. Additionally, Xcel Energy submitted the results of a related EPRI study after the comment period expired. This final report is synthesized from all 13 comment submissions plus the EPRI report. Submitted materials are available on the Department of Commerce website.

Comment Summary

Stakeholders submitted comments addressing numerous issues related to CHP development in Minnesota. The comments can be organized into several interrelated topic areas:

- Policy Options
- Capital Costs and Utility Investment Prospects
- Economic Potential and Value Proposition
- Standby Rates
- Training and Education Needs

Note: Copies of all submitted comments are available for public review at the Minnesota Department of Commerce website.³ This preliminary summary report paraphrases and generalizes comments, and omits figures and citations. Microgrid Institute is solely responsible for any errors or omissions in this summary report.

Policy Options

Comment submissions express various views on CHP policy options proposed by FVB Energy (e.g., to add CHP provisions to Minnesota’s Conservation Improvement Program (CIP), or to establish goals for CHP deployment as part of the state’s existing renewable portfolio standard (RPS) or as part of a prospective alternative portfolio standard (APS)). Several comments also discuss options to encourage consideration of CHP through utility integrated resource planning (IRP) processes before the Minnesota Public Utilities Commission (PUC).

Some commenters note that various options aren’t necessarily mutually exclusive. CenterPoint Energy states that “maximizing CHP could mean pursuing both approaches simultaneously.” And Fresh Energy notes that utilities’ IRP processes could incorporate CHP analysis at the same time that CIP or other policies encourage CHP: “[W]hile individual proposals may not appear to offer large increases in CHP deployment, a suite of policy options considered together may offer greater potential.” The company cautions against disregarding any policy option based solely on its comparative merits versus other, potentially complementary approaches.

Alternative Portfolio Standards:

A few commenters express support for the APS policy option. Great Plains Institute notes that the option shows the highest potential for CHP capacity additions but so far has received comparatively little attention during CHP stakeholder discussions. BlueGreen Alliance observes that CIP policy amendments face limitations and challenges involving industrial companies and their trade unions, while the APS option avoids such issues and represents a more direct approach to encouraging CHP adoption. The Midwest Cogeneration Association suggests that any contemplated portfolio standard program for CHP

³ <http://mn.gov/commerce/energy/businesses/clean-energy/distributed-generation/2014-workshops/chp-meetings.jsp>

should provide bonus incentives for projects located in “grid-challenged” areas, especially to the degree projects can be dispatched to reduce load during peak periods.

Conservation Improvement Program:

While CenterPoint’s submitted comments express opposition to APS and RPS carve-outs for CHP, the company states that it is “open to” CIP policy adjustments for CHP – with some caveats. CenterPoint notes the company’s position that CHP projects shouldn’t favor gas utilities to the detriment of electric utilities, or vice versa. Also it observes that CHP projects are “unusual and do not occur on a regular basis,” suggesting that setting annual CHP goals might be less practical than allowing utilities to apply CHP savings toward their CIP goals. Additionally, CenterPoint asserts that capital cost incentives are more appropriate for CHP than operational incentives, but that if operational incentives are deemed necessary, “then CIP is not the proper source of funding for such incentives.” Moreover CenterPoint objects to the incentive levels discussed in FVB Energy’s proposals, stating that the hypothetical \$0.75/MMBtu incentive exceeds the company’s delivery charge (\$0.4929/MMBtu) for the customers CenterPoint says are most likely to install CHP systems.

The Midwest Cogeneration Association, on the other hand, disagrees with the FVB Energy proposed methodology for calculating energy savings from topping-cycle CHP, asserting that it’s less accurate than other methods and could undervalue actual efficiency achieved. The proposed “tiered” approach, for example, could discourage systems for specific thermal applications that make them inherently incapable of achieving the highest efficiency tiers. Specifically the association “objects to any method that fails to credit a CHP system with 100 percent of its electricity output.”

Additionally the Midwest Cogeneration Association supports the FVB Energy proposed option of creating a system of tradable credits (to help alleviate disparities among utility service territories), but it notes that any such trading program should separate emission reduction credits (ERC) from tradable credits, allowing ERCs to be sold separately or retained for compliance. The association also notes that the trading program merits more detailed discussion than it’s received so far.

Finally the association suggests that any new CHP CIP provisions should encourage participation by large commercial and industrial customers that otherwise have opted out of CIP. Specifically the association recommends considering streamlined approval processes for customers’ self-directed energy efficiency projects, similar to an approach Commonwealth Edison has adopted in Illinois. Additionally the Midwest Cogeneration Association refers to “on-bill” financing options that would allow utilities to finance CHP systems and charge the costs to host customers through their bills over time. The association suggests that such an approach would allow customers to avoid up-front costs and thereby might encourage them to participate in CIP.

Utility Policy Concerns:

The electric utility commenters – Great River Energy, Minnesota Power, Otter Tail Power, and Xcel Energy – expressed opposition to all of the FVB Energy proposed policy options.

Generation and transmission cooperative Great River Energy states that “[e]stablishing a formula for incentives for specific technologies is unprecedented,” and that requirements “to derive a specific percentage of energy ‘savings’ from CHP facilities places an unachievable burden on many of GRE’s member cooperatives.” In particular Great River Energy objects to an alternative compliance payment option for utilities that don’t meet CHP goals, stating that this “troubling” proposal would, in effect, cause GRE members’ to pay for CHP projects outside their service territories.

The three investor-owned utilities (IOU) note that CIP is designed to encourage conservation and not energy production, and therefore CIP is an inappropriate framework for CHP investments – with the exception of waste heat recovery projects, which already can qualify under CIP. Minnesota Power states that topping-cycle CHP projects can’t be compared with current CIP projects because “[r]educing energy usage is always more cost-effective than adding efficiencies to energy production.” Minnesota Power also argues that savings benefits for CIP projects are calculated on a one-year measurement, while CHP projects produce savings measured over many years.

Otter Tail notes that CIP doesn’t provide specific requirements for any particular energy efficiency measure, and doing so for CHP would be unprecedented. Also the company adds that while it hasn’t included customer CHP projects in CIP, it has provided incentives for waste heat recovery through the separate Custom Grant program for commercial and industrial conservation and efficiency improvements. Otter Tail suggests that a Custom Grant approach “creates a neutral playing field for traditional CIP projects and CHP.”

Additionally, Otter Tail Power specifically disagrees with the FVB Energy proposed formula for calculating CHP incentives, stating that it includes administrative costs that aren’t comparably considered for other CIP program offerings. “Including only incentive costs in the formula makes an apples to apples comparison ... and reduces the incentive amount by half.”

Xcel Energy expresses concern about potential cross-subsidy, stating that including topping-cycle CHP applications in CIP would impose cost burdens on residential customers to subsidize investments that primarily benefit commercial and industrial customers. Xcel and Otter Tail both identify potential issues accounting for benefits derived from CHP deployment. Xcel suggests that increasing end-use efficiency by adding CHP would displace natural gas purchases, which could complicate the fair allocation of incentive costs among gas and electric customers. CenterPoint states, however, that solutions “are not difficult to imagine,” including a “system-view” approach that evaluates the overall efficiency of energy use at a facility and assigns energy savings to gas and electric utilities on the basis of total energy saved.

Otter Tail notes that using electric utility CIP funds for a natural gas-fired CHP facility would represent “targeted fuel switching” explicitly prohibited by previous Minnesota policies. Allowing funding for CHP projects through CIP would therefore necessitate allowing consideration of other fuel switching options, according to Otter Tail. Moreover, the company asserts that economic CHP potential in its service territory is “virtually non-existent,” plus it opposes the proposed remedy for such market disparities – *e.g.*, a statewide system of tradable CHP credits.

Minnesota Power expresses concern that economic CHP projects could be dramatically larger than traditional CIP efficiency projects, with the effect that commensurate treatment for CHP could cause it to dwarf other options in existing CIP budgets, and also that adding a separate tier for CHP within CIP would cause utilities to incur administrative costs even if no projects get built. However, the company suggests that if the state decides to add a new tier to CIP, it should implement that tier as a “generation improvement program,” with evaluation criteria designed specifically for evaluating generation projects.

Further, Minnesota Power notes that CHP projects using renewable fuels currently are eligible for cost recovery by utilities, and the company supports giving preference to renewable CHP projects and also supports expanding cost recovery options for CHP projects that aren’t currently eligible to meet RPS requirements, arguing that “these projects provide carbon-free efficiency improvements.”

Integrated Resource Planning:

Great Plains Institute and the Midwest Cogeneration Association suggest that further stakeholder discussion about CHP policy options could be helpful in the context of utility IRP processes. The Midwest Cogeneration Association supports FVB Energy’s proposal to require consideration of CHP in utility IRP, observing that it would help to remedy discrimination against CHP, including third party-owned projects. Xcel Energy reports that its next IRP will include analysis of the costs, benefits, and effects of including higher levels of distributed generation, such as CHP and also photovoltaics and other technologies. Minnesota Power, however, recommends against using IRP processes to evaluate CHP projects. “The IRP planning horizon is 15 years and would require highly generalized assumptions for generic CHP projects many years in the future,” the company states.

Finally, the Minnesota Chamber of Commerce observes that no matter what policy options Minnesota might pursue, new fossil fueled CHP plants must be smaller than 50 MW of generating capacity under current law (*Minn. Stat. §216H.03 subd. 3 (2014)*), and that limitation reduces CHP’s potential efficiency benefits in the state. Unless the law is changed to exempt CHP projects, the Chamber of Commerce suggests “the current statute will continue to contradict Minnesota’s nation-leading energy conservation policies and the federal Public Utility Regulatory Policies Act of 1978.”

Capital Costs and Utility Investment Prospects

Many of submitted comments focus on the potential for utility companies to deploy low-cost capital to install CHP systems at the sites of customers who want CHP and whose thermal loads support the investment.

BlueGreen Alliance identifies “upfront capital cost as the most critical barrier” to CHP expansion. Its comments suggest that third-party ownership models – including utility investment – could help overcome that barrier, and the organization encourages resolving questions involving utility financing and operation of CHP systems located at customer sites. The Minnesota Chamber of Commerce observes that utility rate-base investment in CHP could benefit both utilities and customers by allowing

utilities to earn regulated returns on distributed generation assets while host customers gain access to economical thermal energy. This approach, the Chamber says, would avoid load loss for utilities and allow customers to focus on investments in their primary business interests. Vergent Power Solutions suggests that gas utilities are “best placed to administer incentive programs for CHP.” The company notes however that both electric and gas utilities should be motivated to promote CHP deployment. Fresh Energy recommends gaining additional input from prospective CHP host customers to ensure policies would be acceptable and favorable toward implementing CHP projects.

Third-Party and Customer Financing:

The Western Lake Superior Sanitary District (WLSSD) states that the FVB Energy proposed policy options over-emphasize the economics of IOUs and give utilities too much control over CHP project review, funding, and returns. WLSSD states that many factors influence the way non-IOU organizations evaluate CHP, and suggests that IOUs don’t weigh those factors in the same way. Specifically, WLSSD states that its planned CHP facility could help the organization reduce its carbon footprint, increase its sustainability, and control water treatment costs for customers. Thus WLSSD calls for “a healthy balance” of projects operated by utilities and other organizations. “Policy changes need to provide a satisfactory incentive to encourage both utilities and non-utilities to pursue CHP opportunities,” WLSSD states.

Further, Cummins Power Generation favors policy options that provide flexibility for commercial and industrial energy users to purchase energy from third parties, and for CHP operators to sell their output in energy markets. Cummins suggests greater flexibility would accelerate and expand CHP opportunities by allowing customers to capture CHP benefits “without the burden of high capital expenditures or liability of maintenance and service.”

Utility Financing Issues

Utility commenters express general support for the idea of allowing utility investment in CHP facilities at customer sites. Some of their specific comments and suggestions include the following:

- Great River Energy suggests that clarifying how utilities could invest in CHP might result in greater CHP deployment within existing policy frameworks.
- Otter Tail proposes giving utilities the right of first refusal in ownership of CHP facilities, and limiting the size of third-party and customer-owned CHP systems to the capacity requirements of their thermal hosts.
- CenterPoint emphasizes the need to ensure utility investment in CHP doesn’t expose ratepayers to inappropriate risks, and to clarify the nature of projects that would be suited for utility investment.
- Minnesota Power states, “For future company owned CHP projects to be successful, the regulatory framework for evaluating these projects will need to give more consideration to factors besides cost.” The company cites as recent example the PUC’s disapproval of its plan to put an existing CHP facility into its rate base, on the basis that doing so would marginally increase Minnesota Power’s regulated operating costs.

- Xcel notes that utilities don't always have the tax liabilities needed to make them eligible to benefit from tax-credit incentives often used to encourage clean energy investments.

Great Plains Institute recommends further examination of the prospects and implications of utility investment in CHP facilities of various sizes and types, and notes that questions involving utility investment in distributed generation are being considered as part of its "e21 Initiative," which seeks to examine alternative regulatory approaches such as performance benchmarks for earning returns.

Economic Potential and Value Proposition

Most commenters acknowledge potential for economical CHP, with some disagreement regarding the magnitude of market potential as well as CHP valuation methodologies.

Valuing CHP Attributes:

BlueGreen Alliance asserts that CHP's broad range of benefits justify incentives that appropriately assess the value of its environmental, societal, and system attributes. The Minnesota Chamber of Commerce adds that CHP at high load-factor sites can provide local base-load energy supply that supports grid reliability and reduces the need for transmission investments.

The Midwest Cogeneration Association states that opportunities for economical CHP in Minnesota might be underestimated due to utility avoided-cost tariffs calculated on the basis of marginal generation costs as opposed to the costs of adding new generation in the future. The association adds that Minnesota laws allow "only very limited sales of electricity or thermal energy except by utilities." The result, according to the association, is that CHP projects may be sized only to serve the host facility's electricity consumption rather than to also provide power to the utility grid and thereby achieve greater cost effectiveness and efficiency. Accordingly, the Midwest Cogeneration Association recommends further studying the effects on CHP potential of Minnesota policies regarding avoided cost calculations and limits on third-party sales.

Xcel Energy favors a "holistic and balanced approach" to providing incentives that are intended to serve environmental goals. "It is important that the technology options available for reducing emissions are compared against one another, to provide the maximum environmental benefit for the least customer impact," Xcel states. In addition to cost factors, Xcel recommends that comparisons also should value system factors such as dispatchability.

Otter Tail expresses concern that societal benefits included in CHP valuation are difficult to measure, verify, and quantify. Moreover, the company questions FVB Energy's recommended CO₂ equivalent price of \$25 to \$50 per metric ton, and suggests instead using established CO₂ values of \$9 to \$34 per ton.

Assessing CHP Potential:

Fresh Energy recommends ensuring that policies include measures of CHP value that encourage not only large systems for industrial users, but also smaller units for customers of other sizes. Vergent Power

Solutions echoes this recommendation, and adds that “vast” potential exists for CHP applications at apartment buildings, hospitals, office buildings, data centers, and light industrial and processing facilities, many of which might be relatively small in thermal load requirements.

Great Plains Institute encourages more analysis of opportunities at public sector facilities and institutions, including wastewater treatment facilities. Accordingly, WLSSD notes that its planned CHP project would produce a range of benefits, including greenhouse gas reductions and increased use of local renewable energy resources, and suggests that such benefits deserve appropriate valuation when considering economic potential in the context of state policy goals and the interests of Minnesota energy customers.

Advocacy groups Great Plains Institute and BlueGreen Alliance suggest that mapping waste heat sources and “high value” sites in Minnesota could help prioritize CHP development, as well as utility resource planning and environmental compliance planning efforts.

Xcel Energy’s comments refer to a study performed by the Electric Power Research Institute (*see Appendix B*) estimating the CHP potential in Xcel’s Northern States Power territory. Xcel says the study identifies 305 MW of CHP projects that could achieve payback within six to 10 years. That total, according to Xcel, includes two CHP projects totaling 71 MW now in planning stages, leaving 234 MW of new CHP potential.

Xcel adds that the EPRI study indicates that reducing capital costs by 50 percent increases the total economic CHP potential in the NSP territory by only 15 percent, and that “removing standby rates did not have a huge impact on improving economic potential.”

Standby Rates

Several commenters refer to a parallel process at the Minnesota Department of Commerce related to the Minnesota PUC’s prospective proceeding on standby rates for distributed generation.

Otter Tail Power briefly summarizes its comments to the Department in that process. First, it notes that the PUC’s 2004 order establishing standards for setting standby rates “provides a solid foundation,” and that further standby rate design efforts are unnecessary. Second, the company notes that its standby rate design incorporates many of the attributes recommended by presenters at the Department of Commerce’s Sept. 11, 2014 meeting. Third, it refers to comments from that meeting that suggest that changes to standby rates wouldn’t affect key investment criteria for CHP projects.

Some submitted comments, however, disagree with the assessment that Minnesota’s standby rates are sufficient and effective. Midwest Cogeneration Association reports that its members identify instances in which Minnesota utility standby charges are “not cost justified and unfairly discriminate against distributed generation.” Cummins Power Generation states that the current standby rate structure “severely limits” CHP potential for small commercial and industrial facilities, and WLSSD adds that

uncertainty about standby rates could prevent its proposed CHP project from proceeding. WLSSD notes that current standby rate structures don't support customers' need to anticipate potential standby charges, and they impose fees on the basis of nameplate generating capacity rather than actual customer load patterns and standby energy requirements.

Vergent Power Solutions states that standby rates and exit fees can substantially affect small-scale CHP projects in particular, and accordingly it recommends that such charges should be waived for projects smaller than 500 kW and reduced for projects smaller than 2 MW in size.

Midwest Cogeneration Association encourages the PUC in its generic proceeding to review standby rates on the basis of principles identified by the Energy Resource Center and the Regulatory Assistance Project, namely, that standby charges should be:

- Based on the cost that serving the distributed generation customer poses for the utility;
- Transparent and unbundled to allow for the appropriate allocation of energy, capacity, transmission and distribution, and administrative costs;
- Fair to the utility, the distributed generation facility, and other utility customers – they should not shift costs from one class of customer to another; and
- Structured to encourage partial use customers to efficiently use standby power from the grid.

Training and Education Needs

Some comments provide insight into needs for additional CHP-focused training and education resources in Minnesota. WLSSD notes that many opportunities for CHP may exist, but that customers lack the technical expertise and knowledge to either recognize or exploit those opportunities. WLSSD suggests that making available low-cost (or no-cost) expertise and information resources could help prospective CHP hosts to assess and pursue project opportunities.

Additional comments from stakeholders participating in the Minnesota CHP Stakeholder Engagement process – obtained by telephone survey – suggest that the state's technical workforce is adequately positioned to support CHP project design, construction, operations, and maintenance. However, stakeholders suggest that CHP prospects could benefit from educational capabilities and resources focused on helping energy users assess CHP potential for their facilities, as well as how to manage policy, legal, and finance issues related to project planning and development.

Conclusion: Issues for Consideration

Participants in the Minnesota CHP Stakeholder Engagement process represent a broad cross-section of organizations and individuals in the state's commercial, institutional, and regulatory sectors. Accordingly, they bring a variety of perspectives and experiences to the issues affecting CHP deployment.

Minnesota's utilities express general opposition to CHP policy options that envision new regulatory requirements. Their reasons tend to target the basic assumptions underlying the proposed options – *i.e.*,

estimations of market potential, comparative economics, and underlying environmental and energy policy strategies. Additionally, they indicate concerns about unintended consequences – such as potential cross-subsidies, community burdens without commensurate benefits, and policies that favor natural gas companies at the expense of electric companies.

At the same time, however, Minnesota’s utilities also acknowledge substantial potential for CHP in some parts of the state. And they support policy changes that would clarify their ability to obtain regulated cost-recovery for investments in CHP assets at customer sites where those investments make sense. In all cases, utilities assert their interest in evaluating CHP potential according to the criteria they consider important, in the context of their fiduciary and public utility obligations.

While acknowledging the legitimacy of those interests, however, potential CHP customers and vendors identify structural barriers in current policies and standards that they suggest unnecessarily complicate CHP projects and inflate project costs. Some stakeholders express concern about policies that focus too much on driving utility investment in onsite power systems. Others assert that energy policy priorities support establishing appropriate price signals for environmental, social, and system attributes, and implementation challenges shouldn’t prevent the state from continuing its leadership in promoting conservation and clean energy alternatives to serve customers.

Based on submitted comments and issues discussed during CHP Stakeholder Meeting #3 on Oct. 15, 2014, the Department of Commerce identified the following issues for further examination during Meeting #4, scheduled for Nov. 5, 2014:

- Establishing criteria for evaluating CHP projects and comparing them to alternative solutions
- Identifying “high-value” opportunities to prioritize CHP deployment and resource planning
- Balancing provisions for CHP investment by utilities, customers, and third parties, respectively
- Clarifying the implications of policy options and resolving potential conflicts and unintended consequences
- Developing effective education and assistance tools to facilitate CHP deployment

The Minnesota Department of Commerce welcomes additional input and interaction, and expects to continue the process of CHP stakeholder engagement. In addition to discussion opportunities during additional meetings in the series, the Department expects to arrange a second comment period in the CHP Stakeholder Engagement process. When details about that comment period become available, they will be communicated to stakeholders and publicized via the Department’s website.

Appendix A:

CHP Comment Period Invitation

via email to stakeholders, Sept. 25, 2014

A comment period is now open from September 24 through October 10. The Minnesota Department of Commerce invites stakeholders to submit written comments regarding issues and factors affecting CHP deployment in Minnesota. Possible topics for comment may include, but are not limited to:

- FVB Energy's proposed CHP policy options
- CHP finance, policy, technical application, and education and training needs
- Alternative mechanisms and approaches to facilitate economically efficient deployment of CHP in Minnesota
- Current barriers and issues hindering CHP projects
- Resource planning, strategic, and regulatory factors affecting CHP options and potential
- Any other CHP issues that stakeholders would like to comment on

Please submit written comments in PDF format no later than Oct. 10, 2014, to the following email address: cip.contact@state.mn.us

If you have any questions, please contact Jessica Burdette at Jessica.burdette@state.mn.us or [651-539-1871](tel:651-539-1871) or me via the information in my signature. Thank you!

Adam Zoet

Energy Policy Planner

Minnesota Department of Commerce

85 7th Place East, Suite 500, Saint Paul, MN 55101

P: [651-539-1798](tel:651-539-1798)

Appendix B:

EPRI Xcel Northern States Power Territory CHP Potential Report summary

Background

Resource Dynamics Corp. (under contract with the Electric Power Research Institute) analyzed the technical and economic potential for commercial and industrial CHP projects in the Minnesota service territory of Xcel Energy.

The report includes data pertaining to maximum demand, annual energy consumption, and commercial and industrial segment for customers with maximum demands of 1 MW or larger. Customers with load factors below 20 percent aren't analyzed, with the reason given that their peaky load profiles tend not to support favorable economics with baseload DG/CHP installations. The full report is available via the Minnesota Department of Commerce website.

Summary

The Resource Dynamics Corp. report identifies several key areas that potentially could impact adoption of CHP in Xcel Energy's service territory through 2040. Specifically, it states that the greatest potential is seen in facilities capable of installing CHP systems larger than 1MW.

A key factor affecting the development of CHP systems is payback period. The report shows 305 MW of economic potential with payback periods of six to 10 years. Institutional sites such as colleges and hospitals have demonstrated a willingness to accept longer payback periods for investments like CHP systems. Given a seven- to 10-year payback, this segment shows an economic potential of 105 MW and perhaps the greatest likelihood for market adoption. Typically industrial facilities require payback on such investments in no more than three years, which suggests they are less likely to adopt CHP.

Examining potential financial structures for CHP projects, the report shows that removing standby rate charges improves project economics for all facilities, improving the payback period by up to one year. This increases total economic CHP potential by 22 MW.

The report also indicates that when incentives of up to 50 percent of the installed cost are applied, all high load-factor sites show economic potential, including those in the 100 kW to 1 MW range. The total economic potential is estimated at 471 MW in this case.

Comparing installation incentives to other incentives in terms of their environmental cost-benefit attributes, the report states that providing a 50 percent installation incentive equates to \$104 to \$107 per ton of CO₂ reduction. This outweighs the cost of Xcel Energy's DSM program, which is \$4.32 per ton.

CHP Market and Segment Profile

According to the report, only large industrial facilities, hospitals, universities, and hotels show economic potential in the base case scenario, all for CHP applications that can utilize waste heat for thermal energy.

The report identifies the greatest economic potential at sites capable of installing CHP sized larger than 1 MW. In terms of total CHP capacity, office buildings showed the largest technical potential for economically sized CHP, followed by chemical/petroleum/coal manufacturing. While the economics for hospitals and colleges might not be as strong as large industrial facilities, they have demonstrated willingness to accept lengthy payback periods for investments such as CHP systems.

Potential CHP Demand

The report identifies 628 sites in Minnesota with peak demand greater than 1 MW that show technical potential for CHP systems. However, based on the economic DG/CHP sizing, less than half could support systems larger than 1 MW.

Reported technical potential for CHP based on economic size range:

Size	Number of Sites	Technical Potential (MW)*
100 kW-1 MW	378	202
1-5 MW	223	348
>5 MW	25	217

**For economically sized CHP*

Under current market conditions, the report states that large industrial facilities that can install CHP systems over 5 MW in size have the most attractive project economics (currently limited to paybacks no longer than seven years.)

Hospitals in the 1 to 5 MW size range also show some potential but with seven- to 10-year paybacks, and they may be willing to take on projects with longer payback periods.

CHP Return on Investment

The report showed 305 MW of economic potential with payback periods of six to 10 years. The 105 MW of economic potential from colleges and hospitals in the seven- to 10-year payback range might offer the highest likelihood for market adoption, especially since many manufacturing facilities require three-year paybacks to justify energy investments.

Using regional EIA-predicted escalation rates for electricity and natural gas are less favorable for DG/CHP applications – sites with economic potential in the six- to seven-year range shifted to seven to 10 years, and economic potential declined by more than 100 MW to 203 MW.

The report shows that removing standby rate charges improves project economics for all facilities, typically reducing the payback period by nearly one year. This only increases the economic potential by 22 MW, but stronger economics would make facilities more likely to adopt CHP. Most of the large

industrial facilities in the six- to seven-year payback range shift to five- to six-year paybacks, while hospitals with seven- to 10-year payback periods have shifted to the six- to seven-year range.

The report refers to a 2003 survey “Converting Distributed Energy Prospects into Customers,” performed by Primen Research. The EPRI/Resource Dynamics report selects for analysis this survey’s results for “soft” prospects (aware of CHP as an option) and “strong” prospects (considering DG/CHP) to estimate the percentage of Xcel Energy’s customers that would adopt CHP. The Primen survey results showed that strong prospects may be more willing to accept longer payback periods,

Effects of Incentives on CHP Deployment

The report indicates that when incentives of up to 50 percent of the installed cost are applied, all high load-factor sites (those with significant electric and thermal loads 24 hours a day, seven days a week) show economic potential, even those sized in the 100 kW to 1 MW range. The total economic potential is estimated at 471 MW in this scenario. Incentives of 40 percent or less of installed costs show minimal impact on economic potential and adoption.

The report shows that at the 50 percent cost reduction incentive, the market opens up to CHP systems smaller than 1 MW, with many of these facilities showing economic potential. Additionally, market adoption would occur significantly faster than the base case, with up to 200 MW projected for adoption within five to 10 years. However, the report states that even with a 50 percent cost reduction, many customers (primarily those with potential CHP applications under 1 MW) are still in the seven- to 10-year payback range, where the likelihood of CHP adoption is minimal.

With the base case assumptions, 134 to 179 MW of new CHP capacity is estimated to enter service by 2030, enough to displace between 1,056 and 1,411 GWh of Xcel Energy’s electricity sales. If a 50 percent installed cost incentive were offered, the adoption by 2030 would increase to between 287 and 386 MW of CHP, enough to displace between 2,263 and 3,043 GWh of electricity.

CHP and Emissions Reduction

The report shows an overall reduction in greenhouse gas emissions for all CHP units when the effects of thermal recovery are considered in CHP that fully utilizes the waste heat to displace an 80 percent-efficient natural gas boiler. Considering the cumulative effects of CHP, adopting 220 to 340 MW of new CHP would reduce Xcel’s CO₂ emissions by between 1.8 and 2.7 million total tons by 2025.

The report shows that at an average CHP cost of \$1,700 per kW, \$850,000 would be needed to provide a 50 percent incentive for each MW of total CHP adoption (\$187 to \$289 million for the 220 to 340 MW of CHP modeled in the report). This amounts to the incentives providing \$104 to \$107 per ton of CO₂ reduction. The report compares these figures to the \$4.32 per-ton costs for Xcel Energy’s DSM program.

Appendix E

Combined Heat and Power Stakeholder Meeting #1 (of 4)

Convened 09/03/2014

Meeting Summary Report Prepared For:
Minnesota Department of Commerce - Division of Energy Resources

Prepared By:



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Background

In late 2013, as part of the Energy Savings Goal Study required by the state legislature, the Minnesota Department of Commerce ("Commerce") conducted a series of stakeholder meetings on industrial energy efficiency and combined heat and power (CHP) – including two technical work group meetings focused specifically on CHP – and delivered a report on findings and recommendations to the legislature. In 2014, Commerce funded two CHP research projects that are specific to Minnesota. One study evaluates CHP regulatory issues and policies and developing an up-to-date analysis of CHP technical and economic potential; another study examines the effects of existing standby rates and net metering rules on CHP and Waste Heat to Power projects.

To continue to build on Commerce's past and current CHP work, and to focus on more specific policy details and recommendations, Commerce was awarded a U.S. Department of Energy grant to carry out a strategic stakeholder engagement process and develop an Action Plan. As part of the project's scope of work, Commerce is convening a series of stakeholder engagement meetings to provide information and facilitate discussion on CHP issues involving Minnesota's regulatory framework, technical/economic potential, and education/training needs. These meetings are intended to achieve several primary objectives:

- Inform stakeholders of current efforts underway to increase CHP implementation
- Facilitate discussion regarding the opportunities and barriers to greater CHP deployment
- Solicit ideas for possible solutions to these barriers
- Provide information in the development of an Action Plan, which will act as a roadmap to facilitate greater implementation of CHP projects throughout the state

Meeting Overview

The first CHP Stakeholder Meeting: "CHP Baseline, Value Proposition, and Path Forward" convened on Sept. 3, 2014, from 8:30 a.m. to 12:30 p.m., at the Wilder Center (451 Lexington Parkway North, Saint Paul, Minnesota). The meeting included 60 pre-registered and 14 walk-in attendees, for a total attendance of 74. The primary goal of the meeting was to present information regarding the current state of CHP development while exploring barriers and opportunities in Minnesota. A secondary goal was to address questions among stakeholders and facilitate discussion about the topics presented. The meeting was divided into five presentation sections, with three moderated Q&A sessions providing opportunities for feedback and questions. (*Appendix A*)

The first presentation was provided by Jessica Burdette of the Minnesota Department of Commerce, Division of Energy Resources, who outlined Minnesota's statewide energy policy objectives and provided an overview of the state's CHP initiatives. Next, Michael Burr of Microgrid Institute presented on the CHP Stakeholder Meeting strategy and plan, and reviewed the current baseline, value proposition, and technical potential of CHP in Minnesota. The remainder of Meeting #1 consisted of a three-part presentation by Mark Spurr of FVB Energy, reviewing key highlights from FVB Energy's report

for Commerce, “Combined Heat & Power Policies and Potential.”¹ Spurr’s presentation was divided into three sections:

- CHP overview
- CHP regulatory review findings
- CHP policy analysis options

Spurr focused on both the technical and economic potential of CHP in Minnesota. His presentation addressed many points, most notably:

Technical Potential & Value Drivers

- In Minnesota, there are around 4,000 sites with the technical potential for CHP.
- The state has around 1,000 MW of CHP potential.
- CHP is up to twice as efficient as power-only plants depending on the technology used.
- Minnesota is only 43% efficient in converting fuel to useful energy, which could be improved with greater deployment of CHP technology.
- CHP can enhance local energy resiliency.
- CHP combined can provide grid support during peak periods, especially when combined with demand response.
- CHP can help utilities comply with pending regulations on greenhouse gas (GHG) emissions.

Economic Potential and Issues

- In Minnesota, lower power prices make it more difficult to rationalize the cost effectiveness of developing CHP.
- Based on efficiency per unit, electricity is a higher value energy stream than thermal output, affecting the efficiency credits that a given CHP unit may earn.

CHP Policy Options

- The FVB report offers several policy options for discussion:
 - New CHP tier in natural gas and/or electric utility Conservation Improvement Program (CIP), providing incentives to customers or third parties.
 - CIP credit for utility-owned CIPs (in addition to customer/third-party incentives).
 - Biomass-fired CHP carve-out in either existing or expanded renewable portfolio standard (RPS).
 - New alternative portfolio standard (APS) requiring electric utilities to obtain a given percentage of sales from CHP (regardless of fuel) by a given year.

¹ FVB Energy, Minnesota CHP Policies and Potential Reports:

- ["Minnesota CHP Policy Brief"](#) (.pdf)
- ["Minnesota CHP Regulatory Issues and Policy Evaluation"](#) (.pdf)
- ["Minnesota CHP Technical and Economic Potential"](#) (.pdf)

- Appropriate policies and incentives for electric utilities will most substantially facilitate CHP implementation.

CHP Economics and Financing

- Given the payback periods typically preferred by private institutions, utilities have a sufficiently low weighted average cost of capital (WACC) to make many CHP projects more cost-effective and structurally better positioned to exploit the CHP potential. Without their involvement it will be much harder to reach the CHP potential outlined. With that in mind, it's also important to allow private ownership of CHP.
- CIP or APS policies for utility investment in CHP yield positive results from societal and participant cost tests.
- Capital incentives can be front-loaded to facilitate a shorter return on investment, or they can be spread out over the life of a project. Investment incentives support project costs for equipment and development, while production incentives reward efficient and reliable operation.
- Investing in CHP creates certain risks, most notably the risk of CHP hosts going out of business or otherwise no longer needing CHP thermal output. Utilities investing in CHP expose ratepayers to such risks. However, all forms of energy production carry risks, and CHP's risks should be examined in context of other risks to ratepayers embedded in existing or alternative options.

Action Steps for Consideration

1. Develop a draft "Minnesota CHP Policy Act" for consideration by the legislature in 2015.
2. Develop an interagency working group to integrate potential CHP policy with Minnesota's plan to comply with the EPA's Clean Power Plan.
3. Set goal of doubling CHP capacity from the current 962 MW by the year 2030.
4. Add new CHP tier to CIP for electric utilities.
5. Establish a ruling that utilities may own CHP facilities on customer premises.

Moderated Q&A and Discussion

During the CHP Meeting #1 Q&A and discussion sessions, stakeholders raised questions and offered comments on a wide range of issues, with most focusing on cost effectiveness and financing of CHP systems. In addition, attendees raised questions about how CHP fits into the state's CIP initiative or whether the state should adopt alternative policies such as APS or RPS.

Highlights from the Q&A sessions:

Q: How do load profiles and demand density affect CHP economics? Specifically how large must a site's heat load be in order to make CHP cost effective?

A: In general, the larger a CHP deployment, the better the project's economics will be. The FVB economic potential study assessed a range of sizes, from 30 kW microturbines to a 40 MW combined-cycle facility. Technical advances have improved costs for smaller CHP units but dramatic reductions aren't expected.

The most cost-effective commercial and institutional CHP systems provide thermal energy for district heating and cooling networks.

Q: Does the FVB analysis set a minimum annual efficiency performance in order for a CHP system to be considered economic?

A: It didn't set an efficiency threshold, but not surprisingly, the more cost-effective deployments in the scenarios tended to be more efficient, and the less cost-effective were less efficient.

Q: Different commercial and industrial investors have different expectations for equity returns and payback time on capital investments. Don't some C&I investors have expectations that are similar to those of utilities?

A: Compared to regulated utilities, industrial investors generally have higher hurdle rates for CHP and other kinds of energy efficiency investments. In principle, many investors can accept equity returns and payback rates similar to those offered by typical CHP investments, but their criteria for investment make it more difficult than it would be for utilities.

Q: How do the proposed incentive options correlate with expectations for investment by utilities vs. third parties and customers? In other words, are you saying the incentives should focus on encouraging utility investment?

A: The proposed options aren't intended to suggest utilities should be the sole investors in CHP. Some customers and third parties will want to own and operate CHP plants. That opportunity is important, and the economic signals should be evenly balanced.

Q: During the presentation you indicated some stakeholders expressed concern about utility ownership of CHP. What are those concerns?

A: Over the years there's been experience with utilities getting in the way of CHP, and so there's a certain lack of trust. Also some people see it as a competitive threat because they're actively involved in developing CHP.

Q: Policy Option 3 includes CIP incentives for utility investment in CHP. How would that work?

A: The utility would be able to receive a CIP credit equivalent to the incentive it otherwise would have to provide for customer-owned CHP.

Q: If the utility invests in CHP, would it take the electricity output and provide the thermal output to the host?

A: Correct. This brings low-cost utility capital to CHP deployment, and it also brings the utility's power systems engineering and operations experience. It makes integrating CHP the utility's business. Utilities are well suited to implement CHP projects.

Q: Policy Option 1 and 2 describe CIP credits for electricity and natural gas utilities, respectively. Did the analysis consider combining the two in a shared program as some jurisdictions have done?

A: Yes a combined approach was considered, and it has potential. However, it raises methodological challenges. Gas and electric utilities both have certain requirements, and it could be complicated to handle them in a combined program.

Q: The CIP programs we offer all pass the societal and participant tests with strong results. The study seems to suggest CHP will just barely pass those tests. Might CHP take CIP funds away from more productive investments?

A: The proposed approach yields results for CHP that are comparable to other CIP investments, in terms of dollars per Btu or MWh, based on lifetime efficiency measures.

Q: Many of Minnesota's largest industrial facilities have opted out of CIP. Would they have to opt in to take advantage of incentives for CHP?

A: To the extent CHP is a utility rate-base investment, it would mitigate the need for the industrial host to opt into CIP.

Q: What's the reason for the proposed tiered approach to CIP credits for CHP? Why shouldn't CHP projects be given full credit for their output? If efficiency is factored into the incentives, then projects will benefit to the degree they're efficient, and a tiered system isn't necessary.

A: CHP generates two forms of energy, and the thermal output isn't as valuable as electric output in terms of improving overall efficiency and reducing GHG emissions. The electric sector is about 33 percent efficient, so CHP represents a dramatic improvement in primary energy efficiency. But compared to an existing onsite boiler, a new CHP system may be more efficient, but not radically so. The policy structure should be consistent with the motivating public policy goals for improving efficiency in primary energy reduction and reducing GHG emissions.

Conclusion: Areas for Further Discussion

Subsequent meetings will further examine issues affecting CHP prospects and policy options in Minnesota. Key issues raised in CHP Stakeholder Meeting #1 that merit additional consideration:

1. How do CHP investments compare to other CIP investments, in terms of performance per ratepayer dollar invested?
2. How do CHP benefits compare or contrast between various end-use applications – i.e., industrial, commercial, and institutional?
3. How do the proposed policy options compare, contrast, and complement CHP programs and policies in other U.S. states and the federal government?
4. How do standby rates and net metering policies affect CHP deployment?
5. How should incentives be balanced to ensure equitable treatment of CHP investments by utilities, customers, and third parties?

6. What barriers to utility investment in CHP can be effectively addressed with state policies or programs?
7. How should revenue streams from utility-owned CHP capacity be treated, for regulatory accounting purposes? How might that treatment affect CHP investment factors for utilities?
8. How would utilities claim CIP credits for CHP investments?
9. Given the policy drivers of improving primary energy efficiency and reducing GHG emissions, what's the most effective CIP credit structure to facilitate the most productive deployments?

Meeting #2 in the Minnesota CHP Stakeholder Engagement series is scheduled for Sept. 24, 2014, at the Wilder Center in St. Paul. The meeting is expected to focus on the context for Minnesota's CHP policy options, with presenters reviewing comparable programs in other states, and also the effects of utility standby rates and net metering policies. The results and recommendations of Energy Resources Center's report "Analysis of Standby Rates and Net Metering Policy Effects on CHP Opportunities in Minnesota," will be presented during the stakeholder meeting; the full report can be accessed at the following link: <http://mn.gov/commerce/energy/images/SRNMPE-CHP-Opportunities.pdf>

Appendix A

Agenda

- I.8:15 - 8:30 Registration
- II.8:30 - 8:45 Introduction (Minnesota Department of Commerce and Microgrid Institute)
- III.8:45 - 9:00 CHP baseline and value proposition (MGI)
- IV.9:00-9:45 CHP overview (FVB Energy; Slides 1-21)
- V.9:45 - 10:00 Moderated Q&A
- 10:00 - 10:15 BREAK
- VI.10:15-11:00 CHP regulatory review findings (FVB Energy; Slides 22-30)
- VII.11:00 - 11:15 Moderated Q&A
- VIII.11:15 - 11:45 CHP policy analysis options (FVB Energy; Slides 31-40)
- IX.11:45 - 12:15 Moderated discussion
- X.12:15 - 12:30 Conclusion and housekeeping

Combined Heat and Power Stakeholder Meeting #2 (of 4)

Convened 09/24/2014

Meeting Summary Report Prepared For:
Minnesota Department of Commerce - Division of Energy Resources

Prepared By:



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Background

In late 2013, as part of the Energy Savings Goal Study required by the state legislature, the Minnesota Department of Commerce (“Commerce”) conducted a series of stakeholder meetings on industrial energy efficiency and combined heat and power (CHP) – including two technical work group meetings focused specifically on CHP – and delivered a report on findings and recommendations to the legislature.

In 2014, Commerce funded two CHP research projects that are specific to Minnesota. One study evaluates CHP regulatory issues and policies and develops an up-to-date analysis of CHP technical and economic potential; another study examines the effects of existing standby rates and net metering rules on CHP and waste heat to power projects.

To continue to build on Commerce’s past and current CHP work, and to focus on more specific policy details and recommendations, Commerce was awarded a U.S. Department of Energy grant to carry out a strategic stakeholder engagement process and develop an Action Plan. As part of the project’s scope of work, Commerce is convening a series of stakeholder engagement meetings to provide information and facilitate discussion on CHP issues involving Minnesota’s regulatory framework, technical/economic potential, and education/training needs. These meetings are intended to achieve several primary objectives:

- Inform stakeholders of current efforts underway to increase CHP implementation
- Facilitate discussion regarding the opportunities and barriers to greater CHP deployment
- Solicit ideas for possible solutions to these barriers
- Provide information in the development of an Action Plan, which will act as a roadmap to facilitate greater implementation of CHP projects throughout the state

Meeting Overview

The second CHP Stakeholder Meeting: “Overview and Comparison of State CHP Policies and Programs, Standby Rates, and Net Metering,” convened on Sept. 24, 2014, from 1:00 p.m. to 4:30 p.m., at the Wilder Center (451 Lexington Parkway N., St. Paul, Minnesota). The meeting was attended by 65 people. The primary goals of the meeting were to present information regarding various state policies and utility strategies regarding CHP deployment, as well as information about Minnesota’s standby rates and net-metering tariffs as they pertain to CHP facilities. An additional goal was to address questions among stakeholders and facilitate discussion about the topics presented. The

meeting was divided into two presentation sections, with two moderated Q&A sessions providing opportunities for feedback and questions (*Appendix A*).

The meeting began with an introduction by Jessica Burdette of the Minnesota Department of Commerce, Division of Energy Resources, who welcomed attendees and explained how the CHP Stakeholder Engagement meetings are intended to serve Minnesota's statewide energy policy objectives. Next, Michael Burr of Microgrid Institute presented an overview of discussion topics and outcomes from CHP Stakeholder Meeting #1, which convened on Sept. 3, 2014. The remainder of Meeting #2 consisted of presentations by Cliff Haefke of the U.S. Department of Energy CHP Technical Assistance Partnership – Midwest; Ahmad Faruqui of The Brattle Group (who participated via Internet video conference); Lise Trudeau of the Department of Commerce; and Graeme Miller of the Energy Resources Center at the University of Illinois-Chicago.

Haefke's presentation¹ focused on the U.S. national and state policy context for CHP policies. He discussed emerging drivers for CHP in North America generally, and reviewed President Obama's Aug. 30, 2012 executive order establishing national goals for CHP development as part of national energy efficiency investment initiatives. He explained how some states include CHP in clean energy portfolio standards – including:

- Renewable portfolio standards (RPS) (*CO, CT, HI, ME, NV, and NC*);
- Energy efficiency resource standards (EERS) (*MA, OH, IL, and MD*); and
- Alternative portfolio standards (APS) (*MA*).

Additionally, Haefke described various states approaches to CHP eligibility requirements, minimum efficiency requirements, performance-based metrics, and CHP targets. He provided detailed discussion of programs in Massachusetts (Mass SAVE and APS programs) and Illinois (Energy Efficiency Portfolio Standard).

Following Haefke's presentation, Dr. Faruqui in his presentation² addressed three types of strategic approaches that utilities are taking toward CHP:

- Type I: Blocking CHP
- Type II: Accommodating CHP
- Type III: Pursuing CHP as an Opportunity

Faruqui explained that some utilities that seek to block CHP apply several approaches to discourage customers from adopting CHP, including for example: discounted pricing,

¹ Presentation: U.S. Department of Energy CHP Technical Assistance Partnership – Midwest
<http://mn.gov/commerce/energy/images/DOEPresentation2.pdf>

² Presentation: The Brattle Group
<http://mn.gov/commerce/energy/images/BrattlePresentation2.pdf>

ratcheted demand charges, exit fees, and discriminatory standby service tariffs. Utilities that seek to accommodate CHP, however, work with customers to take advantage of CHP and other alternative technologies without exiting the grid. Utilities that pursue CHP as an opportunity provide interruptible rates and dispatch schedules, and consider investing in CHP at customer sites.

A question-and-answer (Q&A) period followed Faruqui's presentation, during which participants raised questions and offered comments on issues discussed by both Haefke and Faruqui. (*See Moderated Q&A Discussion Summary*).

After a short break, the meeting re-convened with presentations by Trudeau and Miller. Trudeau discussed a parallel process at the Department of Commerce focusing on standby rates for distributed generation generally, pursuant to a Minnesota Public Utilities Commission order on Jan. 27, 2014. Trudeau's presentation³ summarized a Sept. 11, 2014 meeting the Department convened as part of that process, addressing the methodology for setting standby rates in Minnesota, the appropriateness of those rates, how they should be applied for various customers, and their terms and conditions.

Following Trudeau's presentation, Miller⁴ provided the Energy Resource Center's (ERC) analysis of Minnesota standby rates and net metering policies as they pertain to CHP opportunities in the state. Miller defined the characteristics and purposes of standby service generally, and discussed ERC's analysis of standby rate principles, based on the work of several organizations.⁵ These principles include three criteria for comparison:

- *Transparency*: Clear, unbundled pricing;
- *Flexibility*: Treatment of varying customer load requirements, availability factors, system benefits, and regional market purchases;
- *Economically Efficient Consumption*: Peak-sensitive pricing and structures that allow economic demand management by customers.

³ Presentation: Department of Commerce

<http://mn.gov/commerce/energy/images/CommercePresentation2.pdf>

⁴ Presentation: Energy Resources Center

<http://mn.gov/commerce/energy/images/EnergyResourcePresentation2.pdf>

⁵ SEEACTION Policy Guide (2013), U.S. Department of Energy

https://www4.eere.energy.gov/seeaction/system/files/documents/see_action_chp_policies_guide.pdf

NRRI: Electric Utility Standby Rates

<http://www.nrri.org/documents/317330/94c186ab-4f16-4a69-8e8c-ece658e752b1>

EPA, ICF, RAP: Standby Rates for Customer Sited Resources

http://www.epa.gov/chp/documents/standby_rates.pdf

RAP: Standby Rates for Combined Heat and Power Systems

www.raponline.org/document/download/id/7020

Miller then explained the metrics ERC used in the analysis (avoided rate modeling methodology⁶), and discussed the results of the analysis as applied to three of the state's utilities (Xcel, Minnesota Power, and Otter Tail Power). He continued with a discussion of net metering policies and how they interact with other utility policies. Miller discussed how net metering applies to CHP in Minnesota as well as in several other states, and provided recommendations based on ERC's analysis of state practices.

Moderated Q&A and Discussion Summary

Participants in CHP Stakeholder Meeting #2 raised a variety of questions for all three presenters, and they also offered comments on several topics, focusing on ideas and issues involving potential utility investment in CHP, potential interaction of prospective CHP goals and other state policy strategies, and standby rate design considerations and their effects on CHP.

(Note: The paraphrased questions and answers summarized below are drawn from remarks and discussion among numerous participants at the meeting, and therefore they do not represent direct quotes from participants or official guidance from the Minnesota Department of Commerce.)

Q: What examples illustrate the Type III utilities discussed by Dr. Faruqui – i.e., those that pursue CHP investments as a rate-base asset?

A: Some utilities privately are exploring this option but haven't yet brought proposals for consideration. A small number of utilities in the Southeastern United States own or operate CHP facilities.

Q: What characteristics are shared among Type III utilities?

A: Type III utilities tend to view distributed generation as an increasingly substantial factor in the industry. Additionally, their state utility regulators share that outlook and treat such investments accordingly.

Q: What makes CHP different from other utility rate-base assets in terms of cost recovery?

A: A CHP plant's economic performance depends on a stable market for its output, especially thermal energy. If a CHP plant's host ceases using heat, the CHP investment could become a stranded asset affecting customer rates.

Q: Given the potentially larger size of CHP facilities and their longer development lead time, how should policies prevent CHP from crowding out other efficiency and clean energy resource options?

A: Several options could be considered, including establishing dedicated CHP tiers, program adjustment processes, or separate programs. Additionally minimum efficiency

⁶ EPA, *Op cit.*: http://www.epa.gov/chp/documents/standby_rates.pdf

standards could provide parameters that would serve to manage differences among options, including scale and also development time frame.

Q: Please clarify the DOE CHP TAP's recommendation that standby tariffs shouldn't seek to recover capacity costs otherwise recovered in regular rates.

A: If the utility would collect enough from a CHP customer in regular rates to recover the costs of providing that customer's standby services, then that customer shouldn't be subject to standby rates.

Q: How do utility standby rates accommodate customers with varying loads?

A: Supplemental power rate structures and other tariffs can be designed to serve customers with those characteristics.

Conclusion: Areas for Further Discussion

Discussion among participants during CHP Stakeholder Meeting #2 yielded a few key issues for future consideration and clarification:

- Cost-benefit characteristics of CHP versus other energy options serving similar objectives;
- Challenges that some potential hosts face in raising affordable capital for CHP projects with payback exceeding just one or two years; and
- Policy options for prospective CHP plants built larger than required to serve host site requirements to capture greater scale economics.

Meeting #3 in the Minnesota CHP Stakeholder Engagement series is scheduled for Oct. 15, 2014, at the Wilder Center in St. Paul. The meeting will be comprised primarily of two panel sessions during which CHP stakeholders will present views and discuss Minnesota's CHP potential and outlook, and proposed policy options and alternatives for facilitating CHP deployment. Additionally it will include a synthesis of comments received during the comment period convened by DER from Sept. 24 through Oct. 10, 2014. Summary reports and other materials related to the CHP Stakeholder Engagement process are publicly accessible at the DER website:

<http://mn.gov/commerce/energy/businesses/clean-energy/distributed-generation/2014-workshops/chp-meetings.jsp>

Appendix A:

Agenda

Minnesota CHP Stakeholder Meeting #2 (9/24/2014)

- 1:00 - 1:15 Introduction (Commerce)
- 1:15 - 1:30 Review Meeting #1 highlights and proposals (Microgrid Institute)
- 1:30 - 2:00 CHP policy context – state and federal (DOE Midwest CHP TAP)
- 2:00 - 2:30 Strategies for engaging utilities in CHP (The Brattle Group)
- 2:30 - 3:00 Moderated Q&A
- 3:00 - 3:15 BREAK
- 3:15 - 3:30 Summary of Generic Standby Rates proceeding (Commerce)
- 3:30 - 4:00 Standby rates – barriers to CHP and recommendations (ERC)
- 4:00 - 4:30 Moderated discussion (MGI)

Combined Heat and Power Stakeholder Meeting #3 (of 4)

Convened 10/15/2014

Meeting Summary Report Prepared For:
Minnesota Department of Commerce - Division of Energy Resources

Prepared By:



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Background

In late 2013, as part of the Energy Savings Goal Study required by the state legislature, the Minnesota Department of Commerce (“Commerce”) conducted a series of stakeholder meetings on industrial energy efficiency and combined heat and power (CHP) – including two technical work group meetings focused specifically on CHP – and delivered a report on findings and recommendations to the legislature.

In 2014, Commerce funded two CHP research projects that are specific to Minnesota. One study evaluates CHP regulatory issues and policies and develops an up-to-date analysis of CHP technical and economic potential; another study examines the effects of existing standby rates and net metering rules on CHP and waste heat to power projects.

To continue to build on Commerce’s past and current CHP work, and to focus on more specific policy details and recommendations, Commerce was awarded a U.S. Department of Energy grant to carry out a strategic stakeholder engagement process and develop an Action Plan. As part of the project’s scope of work, Commerce is convening a series of stakeholder engagement meetings to provide information and facilitate discussion on CHP issues involving Minnesota’s regulatory framework, technical/economic potential, and education/training needs. These meetings are intended to achieve several primary objectives:

- Inform stakeholders of current efforts underway to increase CHP implementation
- Facilitate discussion regarding the opportunities and barriers to greater CHP deployment
- Solicit ideas for possible solutions to these barriers
- Provide information in the development of an Action Plan, which will act as a roadmap to facilitate greater implementation of CHP projects throughout the state

Meeting Overview

The third CHP Stakeholder Meeting: “Stakeholder Presentation: CHP Market Potential and Policy Options,” convened on Oct. 15, 2014, from 8:30 a.m. to 12:30 p.m., at the Wilder Center (451 Lexington Parkway N., St. Paul, Minnesota). The meeting was attended by 67 people. The primary goals of the meeting were to provide stakeholders from several organizations the opportunity to comment on issues related to CHP market potential and policy options, and to facilitate discussion among participants about the topics presented. The meeting was divided into two panel discussions, with moderated Q&A sessions providing opportunities for feedback and questions (*Appendix A*).

The meeting began with an introduction by Jessica Burdette of the Minnesota Department of Commerce, Division of Energy Resources, who welcomed attendees and

explained the format and objectives of the meeting. Next, Michael Burr of Microgrid Institute presented an overview of discussion topics and outcomes from CHP Stakeholder Meeting #2, which convened on Sept. 24, 2014. Then Burr provided a summary of submissions received by the Department of Commerce during a CHP Stakeholder Comment Period, September 24 through October 10.¹ Burr's presentation summarized comments submitted on several topic areas: FVB proposed policy options; capital costs and utility investment prospects; economic potential and value proposition; standby rates; and training and education needs.

Burr then introduced the first panel discussion, "CHP Market Potential: Economics, outlook, and financing." Panelists included:

Marianne Bohren, Executive Director of the Western Lake Superior Sanitary District (WLSSD). Bohren's responsibilities include providing wastewater treatment and solid waste management for a 530 square-mile area in northeastern Minnesota. Previously she worked for 17 years in a variety of management positions for Potlatch Corp. Marianne holds a Bachelor of Science degree in Chemistry and a Master's degree in business administration from the University of Minnesota Duluth.

Tim Gallagher, Implementation Supervisor for Minnesota Power's Conservation Improvement Programs (CIP). Gallagher is responsible for the design and implementation of the utility's residential, commercial, and industrial energy conservation programs. Previously he served as a residential and commercial customer representative with Superior Water Light & Power in Superior, Wisc. He holds a Bachelor of Arts degree in sustainable business practices as well as energy management and production degrees.

Larry Shedin, LLS Resources, and expert witness for the Minnesota Chamber of Commerce in Xcel Energy's general rate case in Minnesota, organizing the Solar Rate Reform Group (SRRG.) He now works with the Standby Service Reform Group (SSRG), to effect further changes in standby rates for both CHP and non CHP units. Schedin has taken an active role developing strategic energy plans, and advising industrial, utility, commercial and institutional clients as a technical consultant. His current emphases include wind and other alternative energy development along with negotiation of energy purchase and sales agreements.

Sara Letourneau, Director of Field for the BlueGreen Alliance. Letourneau has successfully led many field campaigns focused on clean energy and directed campaigns throughout the Midwest. Most recently she worked with the Clean Energy Jobs Campaign to pass legislation to set aside funds for energy efficiency. Previously she had

¹ Submitted comments are examined in greater detail in "CHP Stakeholder Comments: Final Summary Report," Oct. 29, 2014, available via the Minnesota Department of Commerce website: <http://mn.gov/commerce/energy/businesses/clean-energy/distributed-generation/2014-workshops/chp-meetings.jsp>

a long career as a health care organizer. Letourneau earned a Bachelor's degree in philosophy from the University of Minnesota and grew up in Buffalo, N.Y.

Each panelist presented brief opening remarks, summarized as follows:

- Bohren described the WLSSD, its plans to install CHP systems fueled in part by biogas produced by the wastewater treatment facility, and its interest in Minnesota policies that support such development. In supplementary comments, Bohren explained factors driving the public water utility's decision to invest in CHP, such as: existing anaerobic digesters onsite with surplus capacity; a steam boiler at the end of its lifespan; and electricity costs that represent a large and growing share of expenses. The proposed investment could serve between 30 and 70 percent of the site's electricity needs, with a 12-year investment payback and access to very low cost debt financing (1 percent).
- Gallagher expressed Minnesota Power's support for CHP development, tempered by caution about cost-benefit characteristics, system effects, and potential ratepayer risks posed by CHP projects. He noted the company's opposition to CHP mandates.
- Schedin related his career experience managing CHP project development, starting in Buffalo, N.Y. He explained how qualifying facility (QF) status under the Public Utility Regulatory Policies Act of 1978 (PURPA) enables CHP facilities to sell electric output to utilities for avoided-cost rates. He discussed including distributed generation (DG) in utilities' integrated resource planning (IRP) processes. And he expressed support for rate-base cost-recovery for utility investments in CHP facilities. In later comments he suggested that policy changes to facilitate CHP deployment should apply in utility territories of all types – investor owned, cooperative, and public/municipal – noting that many agricultural processing facilities with favorable load profiles are located in rural areas served by cooperatives and municipal utilities.
- Letourneau described the BlueGreen Alliance and its mission. She described a prospective revolving loan fund that could be used to finance clean energy investments, and provided an update on its status. She also related the support of the organization's partners for policy changes to clarify CHP's role and support development.

Following the panelists' opening presentations, Burr initiated and moderated an open discussion by raising questions and facilitating questions and answers among meeting participants. (*See Q&A summary below.*) Then, after a break, Burr re-convened the meeting by introducing the second panel discussion, "CHP Policy Options – Pros, cons, and questions for consideration." Panelists included:

Nick Mark, Manager for Conservation and Renewable Energy Policy at CenterPoint Energy. He has regulatory responsibility for the company's Conservation Improvement Program. His activities include setting priorities for the program, ensuring the program

complies with state requirements, and leading the development and submission of program plans and status reports. Mark represents CenterPoint on policy matters related to conservation and renewable energy in Minnesota, and serves on the Board of Directors for the Midwest Energy Efficiency Alliance. He holds a Master's degree in public policy from the Humphrey Institute of Public Affairs at the University of Minnesota and a Bachelor of Arts degree from Carleton College.

Bill Black, Government Relations Director for the Minnesota Municipal Utilities Association, which provides education, training and government relations for the state's 125 municipal electric utilities and 32 municipal gas utilities. Among other state and federal initiatives, Black represents MMUA members' shared interests before the Minnesota PUC. He was involved in shaping Minnesota's Next Generation Energy Act in 2006 and 2007. He earned his Bachelor of Arts degree in journalism from the University of Minnesota and his Juris Doctor degree from William Mitchell College of Law.

Paul Lehman, Manager of Compliance for Xcel Energy. Lehman has worked in the utility industry for nearly 40 years, all for Xcel Energy. Over this time, he has worked in a variety of areas for the company including retail electric rate design, transmission regulation and planning, and currently regulatory compliance. He has worked with CHP facilities from a variety of perspectives.

Ken Smith, president and CEO of District Energy St. Paul and its affiliate Ever-Green Energy. Smith previously served as executive vice president and COO of both companies. A recognized leader in community and campus scale energy systems, Smith is engaged in a variety of forums addressing America's energy future. He is a frequent speaker at national and international conferences and regularly briefs local, state, and federal policy makers and regulators. He serves as chair of the International District Energy Association board of directors. He holds a Bachelor's degree in electrical engineering from North Dakota State University and a Master's degree in business administration from the University of St. Thomas in Minneapolis.

Sheldon Strom, President of the Center for Energy and Environment whose programs have served more than 75,000 homes and businesses with energy efficiency programs, provided more than \$200 million in financing, and completed over 100 research projects. Strom has been actively involved in development of energy legislation and utility policies and has a keen grasp of state regulatory procedures. Mr. Strom has a Masters of architecture degree from the University of Wisconsin and a Bachelor's degree in mechanical engineering from the University of Minnesota.

Each panelist presented brief opening remarks, summarized as follows:

- Mark expressed CenterPoint Energy's support for policies to facilitate CHP deployment, and a belief that complexities and uncertainties can be resolved in effective ways. However he also expressed the company's opposition to

mandates for CHP deployment, and concern about providing operating incentives for CHP through the state's CIP program. He reasoned that CIP was designed to support investment not operations, and up-front capital as opposed to operating support is identified as a primary need for CHP projects. He also stated that FVB's proposed incentive levels exceed the company's delivery charges for large customers and are therefore too high.

- Black noted the need to evaluate CHP projects in terms of energy resources that they would replace. He expressed concern about load loss by small (municipal and cooperative) utilities as a result of customers installing onsite generation facilities. He noted MMUA's opposition to CHP mandates including adding CHP provisions in Minnesota CIP policies, and expressed support for a proceeding to update and improve the state's standby rate policies. In subsequent remarks he asserted that franchised utilities are solely authorized to sell electricity in Minnesota irrespective of the purported exemption for serving less than 25 customers.
- Lehman noted Xcel Energy's support for CHP projects that deliver value to customers and also the utility system as a whole. He also stated that the company's standby rates are designed to ensure customers with onsite generation have access to standby services and that they pay for the costs the utility incurs as a result. In subsequent remarks Lehman noted FERC and Minnesota precedent restricting non-utility sales of electricity across public rights of way only.
- Smith expressed concern about providing CHP provisions in Minnesota CIP policies, suggesting that an alternative portfolio standard (APS) would be more appropriate. He observed that policies in Canada might provide effective models for supporting CHP deployment. He suggested that development would benefit from efforts to study and report detailed information about CHP potential in the state. He also expressed support for planning and development of integrated district energy networks including CHP systems.
- Strom observed that CHP's efficiency benefits might be less clear today than they were when projects displaced inefficient coal-fired generation. He expressed opposition to including CHP in CIP, observing that past attempts to expand CIP to include investments in measures other than demand-side efficiency have failed. He noted that utility support for CHP is instrumental to its development. He suggested IRP processes could be effective venues for considering how to incorporate CHP, and that CHP could be incentivized along with other energy supply efficiency efforts as part of programs supporting efficiency improvements in electric utility infrastructure.

Following the panelists' opening presentations, Burr moderated an open discussion among meeting participants. (*See Q&A summary below.*)

Moderated Q&A and Discussion Summary

Participants in CHP Stakeholder Meeting #3 raised a variety of questions for all nine panelists, and they also offered comments and engaged in open discussion on several topics, focusing on CHP market potential, utility investment in CHP, and considerations for facilitating CHP deployment through Minnesota's energy policies.

(Note: The paraphrased questions and answers summarized below are drawn from remarks and discussion among numerous participants at the meeting, and therefore they do not represent direct quotes from participants or official guidance from the Minnesota Department of Commerce.)

Q: Discuss the merit of a revolving loan fund as discussed by panelist Letourneau.

A: The concept sounds good and could work if structured properly, but some experience suggests that customers who can't otherwise arrange financing present substantial credit risks, and in any case they often prefer rebates or other forms of direct capital support rather than low-cost debt financing. Nevertheless the idea has merit and could provide a useful supplement to other forms of financing, including grants.

Q: What criteria and methodologies are needed for evaluating CHP projects?

A: Criteria factors and evaluation approaches are described in multiple public sources.²

Some noted criteria factors include:

- project economics and system economics
- risks to all parties including ratepayers
- use of renewable resources
- environmental impact including net CO₂ emissions and reductions
- fuel sustainability and deliverability
- thermal load factor, stability, and diversity
- operating efficiency, availability, and reliability
- transmission and distribution investment deferrals
- replicability

Project evaluation criteria in the current CIP program apply only to demand-side projects and therefore would require amendment to serve CHP project evaluation. However, some general metrics from CIP may be useful, including CIP's established incentive pricing, equating to approximately \$1 per MMBtu of fossil fuel saved.

Multiple stakeholders added that CHP projects are unique, and while standardized criteria are helpful and perhaps necessary, they do not replace detailed feasibility analysis. Moreover, the unique nature of CHP projects means they can pose some unfamiliar risks, despite initially favorable evaluation using standard methodologies. For example, despite a strong economic case for a CHP project, a host organization might withdraw internal support in favor of other projects and investment options.

² See "CHP Evaluation and Study Resources

Q: CIP historically hasn't provided operational support for projects, but only capital-cost incentives. What's the reasoning behind the FVB Energy proposed CIP operational incentives for CHP?

A: This approach would help to apportion incentives evenly over time rather than in large lump sums that could disrupt CIP program budgets. Additionally, it would provide incentives for projects to continue meeting performance objectives over a long-term period, as opposed to construction incentives for projects that might or might not produce long-term benefits. The fact the CIP program hasn't provided operating incentives shouldn't necessarily prevent consideration for such an approach in the future.

Q: How might CHP projects be used as part of efforts to reduce greenhouse gas emissions, including meeting new U.S. EPA requirements under Section 111(d) of the Clean Air Act, and what does that mean for Minnesota policies facilitating CHP deployment?

A: In addition to including environmental benefits among evaluation criteria, Minnesota policies could provide methodologies to account for emissions reductions achieved by capturing waste heat and thereby reducing fossil fuel consumption. To the degree such methodologies are consistent with state and federal laws, they could in principle be included among efforts to meet regulatory compliance obligations. Such treatment could serve both environmental goals and economic goals by helping to monetize the value of CHP projects' environmental attributes.

Q: With regard to utility rate-base ownership of CHP plants, could some ratepayer risks be avoided by designing modular facilities capable of being relocated in the event of the host site discontinuing thermal load?

A: Such an approach could reduce risks at some small CHP installations but would be impractical for larger-scale facilities of the type that represent the majority of CHP capacity potential.

Q: Utilities have established expertise in cost-effectively owning and operating large-scale power plants. How would operating CHP facilities at customer sites affect utility costs?

A: Depending on how projects are treated, operating costs could be billed directly to host customers, or they could be included in the utility rate base along with costs for operating other utility generation plants. Alternatively third parties could provide operations and maintenance services with costs borne either directly by host customers, or by the utility as part of an operating contract arrangement.

Q: What are appropriate roles for third parties in CHP development, ownership, and operation in Minnesota?

A: Already third parties are working with host customers to evaluate and promote CHP project opportunities, and third parties can own and operate onsite generation under various arrangements. Some utilities express opposition to third-party sales of

electricity, especially to the degree it could reduce customer loads necessary to support cost recovery. Additionally the involvement of a third party in a project can introduce an additional set of interests and thereby complicate project evaluation.

Q: Are CHP projects becoming more common at water and wastewater treatment facilities, like the one described by WLSSD? Through what venues do water facility executives exchange information about such opportunities?

A: Yes such projects are becoming more common at water and wastewater facilities, as well as solid waste management facilities. One of the most active organizations in this area is the National Council for Air and Stream Improvements.

Q: Could new CHP projects create jobs in the state of Minnesota, and if so has that potential been studied and quantified?

A: Such potential wasn't thoroughly studied in the recent CHP reports prepared by FVB Energy. Anecdotes suggest that policies favorable to CHP can help to support commercial, institutional, and industrial development and thereby create jobs directly and indirectly; for example, CHP capacity at a coal-fired power facility in North Dakota is attributed with attracting multiple large industrial employers. CHP's clean energy and resilience benefits can serve local communities' infrastructure modernization and economic development objectives. Finally, several CHP-related equipment manufacturers and other companies provide employment opportunities in Minnesota.

Conclusion: Areas for Further Discussion

Discussion among participants during CHP Stakeholder Meeting #3 yielded several key issues for future consideration and clarification. These issues are expected to be discussed further during Meeting #4 in the Minnesota CHP Stakeholder Engagement, scheduled for Nov. 5, 2014, at the Wilder Center in St. Paul. Focus topics include:

1. **CHP Evaluation Criteria:** Considerations and approaches for fair, accurate, and comprehensive assessment and valuation of CHP attributes.
2. **Mapping CHP Opportunities:** Empirical study and granular analysis of opportunities for topping-cycle and bottoming-cycle CHP projects.
3. **CHP Ownership Problems and Solutions:** Issues and options involving utility resource planning, ratepayer risks, market power, and behind-the-meter operations.
4. **Adapting CIP for Supply-Side Investments:** Establishing and clarifying CHP provisions in Minnesota's Conservation Improvement Program (CIP).
5. **Education and Training Needs and Options:** Prioritizing knowledge gaps and defining options for CHP education and training.
6. **Standby Rate Generic Proceeding Update:** Status and next steps in Minnesota PUC standby rate policy proceeding.

Summary reports and other materials related to the CHP Stakeholder Engagement process are publicly accessible at the DER website:

<http://mn.gov/commerce/energy/businesses/clean-energy/distributed-generation/2014-workshops/chp-meetings.jsp>

Appendix A:

Agenda

Minnesota CHP Stakeholder Meeting #3 (10/15/2014)

- I. 8:15 – 8:30 Registration
- II. 8:30 – 9:00 Introduction (Minnesota Department of Commerce)
- III. 9:00 – 9:30 CHP Stakeholder Comments Summary Report (Microgrid Institute)

Panel #1: CHP Market Potential – Economics, outlook, and financing

Minnesota Power

Western Lake Superior Sanitary District

BlueGreen Alliance

LLS Resources

- IV. 9:30 – 10:00 Panel #1: Opening Remarks
- V. 10:00 – 10:45 Panel #1: Moderated Panel Discussion and Q&A
- VI. 10:45– 11:00 Break

Panel #2: CHP Policy Options – Pros, cons, and questions for consideration

Xcel Energy

Minnesota Municipal Utilities Association

Center for Energy and Environment

CenterPoint Energy

Ever-Green Energy

- VII. 11:00 – 11:30 Panel #2: Opening Remarks
- VIII. 11:30 – 12:15 Panel #2: Moderated Panel Discussion and Q&A
- IX. 12:15 – 12:30 Next Steps (Microgrid Institute)

Appendix H

Combined Heat and Power Stakeholder Meeting #4 (of 4)

Convened 11/5/2014

Meeting Summary Report Prepared For:
Minnesota Department of Commerce - Division of Energy Resources

Prepared By:



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Background

In late 2013, as part of the Energy Savings Goal Study required by the state legislature, the Minnesota Department of Commerce (“Commerce”) conducted a series of stakeholder meetings on industrial energy efficiency and combined heat and power (CHP) – including two technical work group meetings focused specifically on CHP – and delivered a report on findings and recommendations to the legislature.

In 2014, Commerce funded two CHP research projects that are specific to Minnesota. One study evaluates CHP regulatory issues and policies and develops an up-to-date analysis of CHP technical and economic potential; another study examines the effects of existing standby rates and net metering rules on CHP and waste heat to power projects.

To continue to build on Commerce’s past and current CHP work, and to focus on more specific policy details and recommendations, Commerce was awarded a U.S. Department of Energy grant to carry out a strategic stakeholder engagement process and develop an Action Plan. As part of the project’s scope of work, Commerce convened a series of stakeholder engagement meetings to provide information and facilitate discussion on CHP issues involving Minnesota’s regulatory framework, technical/economic potential, and education/training needs. These meetings were intended to achieve several primary objectives:

- Inform stakeholders of current efforts underway to increase CHP implementation
- Facilitate discussion regarding the opportunities and barriers to greater CHP deployment
- Solicit ideas for possible solutions to these barriers
- Provide information in the development of an Action Plan, which will act as a roadmap to facilitate greater implementation of CHP projects throughout the state

Meeting Overview

The fourth CHP Stakeholder Meeting: “Discussion and Synthesis of Major Themes,” convened on Nov. 5, 2014, from 8:30 a.m. to 12:30 p.m., at the Wilder Center (451 Lexington Parkway N., St. Paul, Minnesota). The meeting was attended by approximately 60 people. The primary goals of the meeting were to facilitate discussion among participants synthesizing the results of previous meetings, submitted comments, and analysis by Commerce and its consultants. The meeting was divided into two segments, with moderated discussion of five key themes and synthesis of detailed inputs (*Appendix A*):

- 1. CHP Evaluation Criteria**
- 2. Mapping CHP Opportunities**

- 3. CHP Ownership Problems and Solutions**
- 4. Adapting CIP for Supply-Side Investments**
- 5. Education and Training Needs and Options**

The meeting began with an introduction by Jessica Burdette of the Minnesota Department of Commerce, Division of Energy Resources, who welcomed attendees, explained the objectives and context of the meeting, and introduced the discussion moderator (Michael Burr of Microgrid Institute). The moderator presented an overview of discussion topics and outcomes from CHP Stakeholder Meeting #3, which convened on Oct. 15, 2014. The presentation identified major themes discussed in submissions received by the Department of Commerce during a CHP Stakeholder Comment Period, September 24 through October 10.¹ The moderator then opened the first segment of the meeting, which focused on two major themes: CHP Evaluation Criteria and Mapping CHP Opportunities.

(Note: The paraphrased discussion and synthesis notes summarized below are drawn from remarks and discussion among numerous participants at the meeting, and therefore they do not represent direct quotes from participants or official guidance from the Minnesota Department of Commerce.)

1. CHP Evaluation Criteria

The moderator asked participants to focus on considerations and approaches for fair, accurate, and comprehensive assessment and valuation of CHP attributes. Specifically:

- *What existing methodologies or criteria provide examples to inform CHP evaluation approaches in Minnesota?*
- *What criteria should be included in evaluating CHP projects?*
- *How should CHP evaluation fit into Minnesota's other energy planning and evaluation processes?*

The moderator referred to numerous evaluation models, criteria, programs, and studies identified by Microgrid Institute (*see Appendix B*), and asked participants to suggest other models that Minnesota should consider. Three comments were noted:

- Total resource cost (TRC) tests should be considered
- Cost savings should be calculated in ways that are fair and comprehensive
- Transparency should be a hallmark of any criteria or methodologies for evaluating CHP attributes

The discussion then focused on specific criteria that should be included in evaluating CHP projects. The moderator briefly referred to the Illinois Department of Commerce

¹ Submitted comments are examined in greater detail in "CHP Stakeholder Comments: Final Summary Report," Oct. 29, 2014, available via the Minnesota Department of Commerce website: <http://mn.gov/commerce/energy/images/UpdatedFinalizedCHPStakeholderCommentsSummary.pdf>

and Economic Opportunity (DCEO) CHP pilot program and its tests and criteria, specifically:

Illinois DCEO Test Methodologies:

- *Cost-effectiveness test*
- *Energy efficiency – calculation and measurement*
- *Energy savings – calculation and attribution*

Illinois DCEO Criteria:

- CHP capacity
- Operating hours
- Recoverable heat from CHP
- Electric efficiency
- Thermal utilization
- Displaced thermal efficiency
- Parasitic loads
- Installation cost (major equipment, engineering, design, construction, permitting, interconnection, other)
- Maintenance cost (estimated fixed and variable cost; estimated downtime; planned maintenance contract terms (5-year contract required))

Stakeholder Suggested Criteria:

Participants identified numerous specific criteria to be considered:

General criteria	Efficiency/energy savings
	Fuel type
	Environmental impact
	Risk-reward analysis
	Overall societal benefits
Location-specific criteria	Location-specific value to or effect on grid and system resources
	Local fuel production capabilities
	Demand for CHP outputs
	Resilience both for host and local grid
Utility grid/system operations criteria	Peak supply capabilities
	Dispatchability
	Operating flexibility, including storage capabilities (thermal and electricity)
	Net impact on utilization of renewables (e.g., to what degree would baseload CHP lead to wind curtailment etc.)

Criteria Evaluation Considerations:

Participants offered additional comments on issues related to the criteria discussed:

- Environmental impact analysis should consider both thermal and electric output.
- Environmental impact criteria may include EPA Section 111(d) compliance benefits, but such benefits should be evaluated in comparison to other means of reducing Minnesota's greenhouse gas footprint.
- Evaluation methodologies and systems should be both flexible and driven by goals established by the State of Minnesota.
- Evaluation methodologies may be able to address a broader range of attributes and factors if they are separated from Minnesota's existing Conservation Improvement Program (CIP).
- Efficiency and energy savings criteria may include a minimum threshold.
- Energy savings should be calculated and allocated in a way that is fair and encourages cost-effective efficiency investments by either electric or gas utilities.
- Fuel switching issues bear further definition and analysis to ensure evaluation criteria avoid conflicts with existing regulations while also facilitating economical investments to achieve energy savings.

Minnesota Energy Planning and Evaluation Considerations:

The meeting discussion then focused on how CHP evaluation methodologies should fit into Minnesota's other energy planning and evaluation processes. Participants offered several comments:

- Pilot projects and demonstration programs serve to advance development frameworks, clarify alternative project approaches and structures, and test their viability.
- Policy development should consider whether and how CHP may affect other resources evaluated during integrated resource planning (IRP) processes.
- Least-cost planning processes merit adaptation to allow objective consideration of non-cost factors when evaluating utility CHP investments.
- Some participants suggested IRP's specific scope of study may not effectively serve CHP evaluation, which depends fundamentally on project-specific factors with many indeterminate variables for the IRP time horizon.
- As a counterpoint, however, it was noted that the IRP framework may provide utilities with an opportunity to think about CHP and district energy in long-term planning.
- CHP evaluation should be separated from CIP demand-side conservation project evaluation and budgets.

2. Mapping CHP Opportunities

The moderator asked participants to consider options and factors involving empirical study and granular analysis of opportunities for topping-cycle and bottoming-cycle CHP projects:

- *What primary goals and objectives would be served by additional efforts to map CHP potential in Minnesota?*
- *What kind of information should be studied? What details should be provided?*
- *How should market study efforts interact with and support long-range planning regarding integrated district heating and cooling and other local energy and economic development initiatives?*

CHP Mapping Objectives:

Participants offered numerous comments related to drivers and objectives for additional efforts to map CHP potential in the state:

- Except for limited utility studies, efforts to identify CHP opportunities tend to happen only with policy impetus.
- The role of the State of Minnesota in mapping opportunities bears clarification; existing models such as wind resource potential maps provide analogue examples in some respects.
- Some aging boilers already have been identified for upgrades or replacement to comply with federal Boiler MACT (Maximum Achievable Control Technology) regulations.
- State mapping efforts might identify thermal and electric savings opportunities that might not be considered in evaluations by utilities or customers.
- Initial efforts might naturally focus on CHP opportunities at public facilities, including district energy systems.
- Some examples (*e.g.*, Iowa and Wisconsin) illustrate state approaches to mapping and tracking biogas generation, use and disposal.
- Potential models for Minnesota include programs encouraging utilities to identify energy efficiency studies.
- Project feasibility studies, potentially with State support, would also help clarify potential for CHP development.

Potential Study Areas:

Participants suggested several topics for possible focus through a State-initiated study effort:

- Public facility CHP potential
- Critical local resilience and preparedness requirements
- Economic development needs and opportunities
- Studies of information not accessible to utilities, including customers' proprietary or confidential data
- Heat recovery additions at existing generation facilities
- Small-scale applications

Long-Range Planning Studies:

The moderator asked participants to consider how CHP market study efforts should interact with and complement long-range planning efforts in the state, including local

community resilience, integrated district energy, and economic development initiatives. Several participants referred to earlier comments regarding opportunities to consider CHP in the context of long-range community planning and State preparedness planning. Additionally participants observed that challenges affecting CHP mapping and IRP processes also factor into long-range planning considerations generally.

3. CHP Ownership Problems and Solutions

After a break, the moderator re-convened the meeting to focus on CHP ownership problems and solutions. The discussion addressed issues and options involving utility resource planning, ratepayer risks, market power, and behind-the-meter operations:

- *What regulatory or legal issues affect utilities' ability to finance, own, and operate CHP projects?*
- *What regulatory or legal issues affect the ability of third parties and customers to finance, own, and operate CHP projects?*
- *How can Minnesota best address these issues to facilitate CHP financing and deployment?*

Regulatory Issues - Utility CHP Investment:

Discussion identified several regulatory and legal issues affecting utilities' ability to finance, own, and operate CHP projects:

- Stranded asset risks
- Statutory size limitations; Minn. Stat. 216H prevents baseload plants larger than 50 MW
- Reliability, integration, and risk-mitigation costs
- Utility service obligations and restrictions
- Least-cost planning requirements and cost-calculation, apportionment, and recovery provisions
- Lack of mechanisms to attach a value to thermal output
- Potential fuel-switching regulations and considerations

Regulatory Issues - Third-Party and Customer CHP Investment:

Participants observed a few key regulatory and legal issues affecting the ability of third parties and customers to finance, own, and operate CHP projects:

- Statutory size limits (Minn. Stat. 216H and PURPA) constraining potential for economic CHP development
- Limitations and restrictions on the ability to transport power and integrate generation resources
- Limitations on power and heat sales by non-utility companies

Regulatory Roadmap for CHP Investment:

Discussion focused on several considerations and options to facilitate CHP financing and deployment:

- Potential 216H waiver process or alternative treatment for CHP facilities that achieve certain benefit thresholds – *e.g.*, high efficiency
- Incentives to reduce up-front capital costs
- Direct support for ancillary infrastructure investments
- Financing programs to reduce costs of capital
- Flexible rate treatment including on-bill repayment for utility investments in customer-side CHP
- Transparent, unbundled pricing for standby rates and avoided cost calculation

4. Adapting CIP for Supply-Side Investments

Discussion addressed considerations regarding establishing and clarifying CHP provisions in CIP:

- *How can CHP projects serve CIP goals under current policies?*
- *What CIP changes would most effectively support CHP without disadvantaging demand-side efficiency improvements?*
- *How should supply-side CIP provisions interact with the Utility Infrastructure Improvement program?*

Supporting CHP through CIP

Participants identified only the opportunity for bottoming-cycle CHP to qualify for CIP incentives, and addressed questions related to expanding or adapting CIP to encourage topping-cycle CHP and other generation and utility infrastructure investments:

- Segregating a new category of supply-side conservation opportunities with new and separate goals and incentives.
- CIP generation efficiency provisions should accommodate and support both large and small CHP projects.
- Cost-benefit analysis, metrics, goals, and evaluation methodologies could address supply-side and electric utility infrastructure investments.

5. Education and Training Needs and Options

The moderator described education and training needs as identified in earlier meetings and survey processes, and asked participants to consider priorities for addressing knowledge gaps in CHP knowledge, capabilities, and education resources:

- *What are the most important gaps in CHP knowledge, capabilities, and education resources?*
- *What kinds of education and outreach resources would most effectively fill those gaps?*
- *What examples can inform Minnesota's effort to ensure effective CHP education and training resources are available to support the State's policy goals?*

CHP Knowledge Gaps:

Participants identified several key areas with opportunities for improvement in market knowledge, capabilities, and education resources in the state:

- Laws, regulations, and policy and administration processes
- Interconnection and permitting policies and procedures
- Financing approaches and resources
- Strategic planning and option valuation
- CHP operation and related areas, such as building automation

Participants suggested knowledge gaps related to energy technology generally, and CHP in particular, among various groups including legislators and staff. Additionally, information “silos” among government agencies limit accessibility of knowledge, affecting inter-agency programs and regulatory treatment.

CHP Education and Outreach Resources:

The moderator asked participants to consider the types of education and outreach resources that would most effectively address the identified knowledge gaps.

Suggestions included:

- Programs supporting publicity, public outreach, and education regarding energy initiatives and assets
- Workshops and seminars
- Information resources, such as background materials, guides, and checklists
- Webinars and other multimedia programs

Participants identified a few examples of initiatives to ensure effective CHP education, including online resources provided by Baltimore Gas & Electric and webinars and other programs offered by the State of Illinois under the DCEO pilot program.

Conclusion: CHP Action Plan Next Steps

As part of the Department of Commerce’s process to develop a CHP Action Plan, the fall 2014 CHP stakeholder engagement process provided information and facilitated discussion on a wide range of issues affecting CHP opportunities and development in the state. Next steps in the process (*and estimated timeframes*) include:

- Post-Engagement Survey of CHP stakeholders – identifying priorities for CHP Action Plan (*December 2014*)
- Final Report on the CHP stakeholder engagement process (*January 2015*)
- CHP Education and Training Plan (*January 2015*)
- Post-Engagement Stakeholder Survey Results Report (*January 2015*)
- Draft of CHP Action Plan (*February 2015*)
- Webinar and Comment Period #2 on Draft CHP Action Plan (*February 2015*)
- Final CHP Action Plan (*April 2015*)
- Final CHP Action Plan Webinar and Continued Stakeholder Engagement (*May – December 2015*)

Summary reports and other materials related to the CHP Stakeholder Engagement process are publicly accessible at Commerce's website:

<http://mn.gov/commerce/energy/businesses/clean-energy/distributed-generation/2014-workshops/chp-meetings.jsp>

Appendix A:

Agenda

Minnesota CHP Stakeholder Meeting #4 (11/5/2014)

8:30 – 8:45: Introduction and Review (Department of Commerce and Microgrid Institute)

8:45 – 10:45: **Major Themes – Part I**

1. ***CHP Evaluation Criteria***
2. ***Mapping CHP Opportunities***
3. ***CHP Ownership Problems and Solutions***

10:45 – 11:00: **Break**

11:00 – 12:15: **Major Themes – Part II**

4. ***Adapting CIP for Supply-Side Investments***
5. ***Education and Training Needs and Options***

12:15 – 12:30 Wrap-up and Next Steps (Minnesota Department of Commerce)

Appendix B:

Project Evaluation Methodologies, Criteria, and Resources

Source: Microgrid Institute

<http://www.microgridinstitute.org/project-evaluation-methodologies-criteria-and-resources.html>

U.S. DOE CHP and DG Deployment Resources

<http://www.energy.gov/eere/amo/technical-white-papers>

Rutgers University Costs and Benefits of Combined Heat and Power (used by NJBPU in NJ Clean Energy Program)

<http://ceeep.rutgers.edu/wp-content/uploads/2013/11/CHPCostBenefitAnalysis.pdf>

U.S. EPA CHP Partnership – CHP Project Development Handbook

http://www.energy.gov/sites/prod/files/2013/11/f4/chp_project_development_handbook.pdf

U.S. Dept. of Housing and Urban Development CHP Feasibility Screening Guide for Multifamily Housing

<http://www.energy.gov/sites/prod/files/2013/11/f4/chpguide2.pdf>

NYSERDA CHP Acceleration Program

<http://www.nyserda.ny.gov/Energy-Innovation-and-Business-Development/Research-and-Development/Onsite-Power-Applications/Combined-Heat-and-Power.aspx>

University of Illinois at Chicago CHP Resource Guide

http://www.midwestchptap.org/Archive/pdfs/Resource_Guide_10312005_Final_Rev5.pdf

Illinois Department of Commerce and Economic Opportunity (DCEO) Pilot CHP Program

<http://www.erc.uic.edu/energy-efficiency/illinois-energy-now-programs/dceo-chp-pilot-program/>

District Energy St. Paul “Energy Island” Study (including evaluation methodology and tools)

<http://www.districtenergy.com/2013/02/studies-and-reports/>

Green Banks etc.:

Connecticut Green Bank (formerly CEFIA)

<http://www.ctcleanenergy.com/>

Maryland Green Bank (in development)

<http://mdcleanenergy.org/green-bank-study>

New York Green Bank

<http://greenbank.ny.gov/>

New Jersey Resilience Bank

<http://www.njrb.com/>

CHP in Minnesota:

Technical and economic potential

In addition to combined heat and power (CHP) systems currently operating in Minnesota, the state has substantial potential for new deployment. A 2014 study commissioned by the Minnesota Department of Commerce showed the state has technical potential to add about 3,100 MW of new combined heat and power and waste-heat-to-power (WHP) capacity. Of that technical potential, 984 MW is considered economic, given current market factors and technology

options, with payback periods of 10 years or less. (See Fig. 1).

Most of Minnesota's economic potential for new CHP is located in high load-factor areas in the Xcel Energy and Minnesota Power service territories.

The study showed that without new policies, more than 200 MW of new CHP and WHP capacity is expected to be implemented by 2030. With new policies and incentives, Minnesota could add anywhere from 100 MW to 840 MW of new CHP and WHP capacity, beyond the base case. If utilities invest in new systems, Minnesota's total CHP capacity could double by 2030 under the base case. (See Fig. 2).

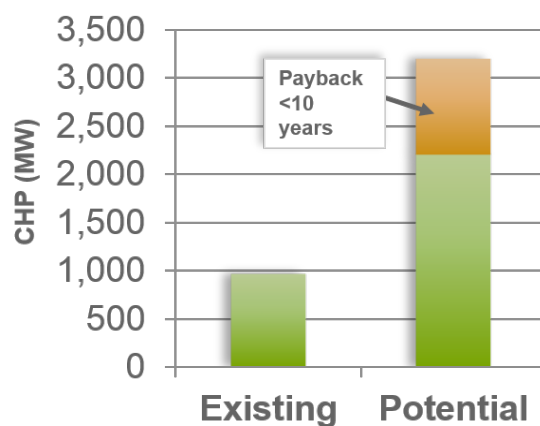


Fig. 1: Existing CHP capacity in Minnesota vs. technical and economic potential. (Source: Minnesota CHP Policies and Potential Report, FVB Energy, July 2014)

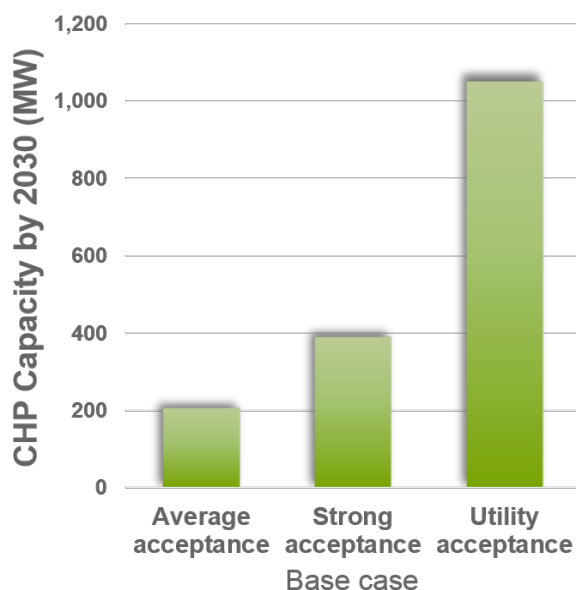


Fig. 2: Projected 2030 new CHP market penetration without new policies under three acceptance curves. (Source: ICF, FVB Energy.)

CHP Economics

Key economic factors for CHP include:

- **Host requirements:** Sites that need resilient, year-round thermal and electric energy supply represent the best candidates for CHP deployment.
- **Commodity prices:** Low-cost gas accelerates payback. Low-cost electricity extends payback time.
- **Costs of capital:** Lower-cost funding increases deployment potential.
- **Policy and regulation:** Greenhouse gas regulation improves the CHP business case. Unfavorable or uncertain policies increase regulatory and financial risk.



Produced by Microgrid Institute for the Minnesota Department of Commerce, Division of Energy Resources (August 2014). Some content courtesy FVB Energy.

CHP in Minnesota:

Baseline and value proposition

Combined heat and power (CHP) systems in Minnesota today provide about 962 MW of generating capacity – more than 6% of Minnesota's total electric generation (Fig. 1).

CHP systems in Minnesota are used in a variety of applications, from powering hospitals to mining taconite. The largest portion of Minnesota's CHP capacity is found in energy-intensive industrial settings (Fig. 2).

The biggest CHP units in Minnesota are at chemical plants and paper mills. But commercial and institutional sites –

such as district energy systems, hospitals, and universities – are home to 30 percent of the state's total CHP capacity.

Small CHP systems (<5 MW each) represent only 3% of Minnesota's CHP capacity. However, recent trends show rapid growth in small CHP systems; since 2005, small systems accounted for 46% of new CHP capacity.

CHP systems are located across the state, with the majority (54%) located in Xcel Energy's territory – which includes the Minneapolis/St. Paul metro area.

CHP Advantages

Key drivers for CHP in Minnesota:

- **High efficiency:** 35%+ fuel savings compared to utility power plants combined with onsite boilers.
- **Resilience and reliability:** Onsite energy systems can operate through utility outages.
- **Emissions reductions:** More efficient systems burn less fuel and pollute less.
- **Fuel flexibility:** CHP uses many fuels, from natural gas to agricultural waste.

Survey:
'My organization's direct experience with CHP has been:'

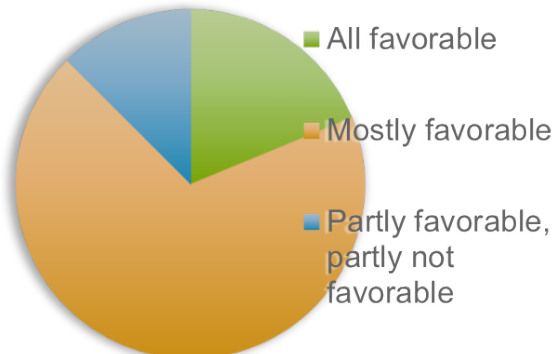


Fig. 3: Minnesota organizations report favorable experience owning and operating CHP systems. (Source: *Minnesota CHP Stakeholder Perspectives Survey, August 2014, Microgrid Institute.*)

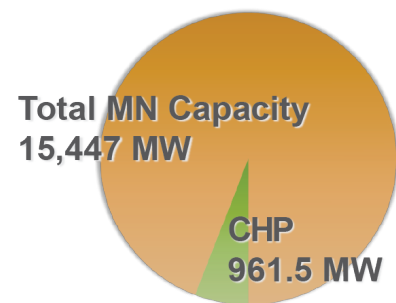


Fig. 1: CHP systems provide 6.2% of Minnesota's electric generating capacity. (Sources: EIA, ICF)

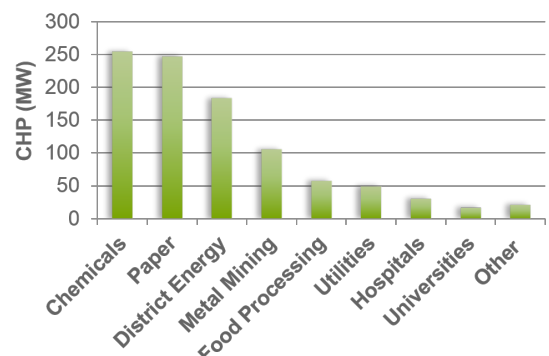


Fig. 2: Minnesota's industrial and processing companies use most of the state's CHP, with a substantial share serving district energy and other commercial facilities. (Source: ICF)



Produced by Microgrid Institute for the
Minnesota Department of Commerce,
Division of Energy Resources (August 2014).
Some content courtesy FVB Energy.

Minnesota policy and CHP:

Increasing efficiency, reducing emissions

In the Next Generation Energy Act (NGEA), the Minnesota Legislature in 2007 established statewide goals relating to energy conservation, renewable energy, and greenhouse gas (GHG) emissions. These and other State policies create frameworks for CHP to help address Minnesota's energy goals.

The NGEA set specific goals to reduce fossil fuel use and GHG emissions. The Act established a goal of reducing per-capita use of fossil fuel 15 percent by the year 2015 (*Minn. Statutes 2016C.05 Subd. 2*). It also established GHG reduction goals (*Minn. Stat. 216H.02*) and called for a climate change action plan for Minnesota.

Minnesota GHG goals

The Next Generation Energy Act established goals to reduce statewide GHG emissions from 2005 levels by:

- 15 percent by 2015
- 30 percent by 2025
- 80 percent by 2050

In 2008, the Minnesota Climate Change Advisory Group recommended that the Legislature provide "incentives and resources to promote CHP." (See Fig. 1).

Conservation Improvement Program

The NGEA established a goal to save energy totaling 1.5 percent of average retail gas and electricity sales beginning in 2010. The Act specified that electric utilities may allocate toward this goal their savings from qualified improvements to generation, transmission, or distribution facilities.

Portfolio Standards

The NGEA set a goal to derive 25 percent of Minnesota's energy from renewable sources by the year 2025 (*Minn. Stat. 216C.05 Subd. 2*). CHP plants that burn biomass fuels, such as agricultural waste, woody biomass, and landfill gas, can contribute toward meeting Minnesota's RPS goals.

Integrated Resource Planning

The Minnesota Public Utilities Commission (PUC) reviews integrated resource plans (IRP) filed by electric utilities every two years. As part of IRP, each utility is required to file a GHG mitigation plan, including total CO₂ emissions and the effects of various strategies (*Minn. Stat. 216B.2422 Subd. 4*).

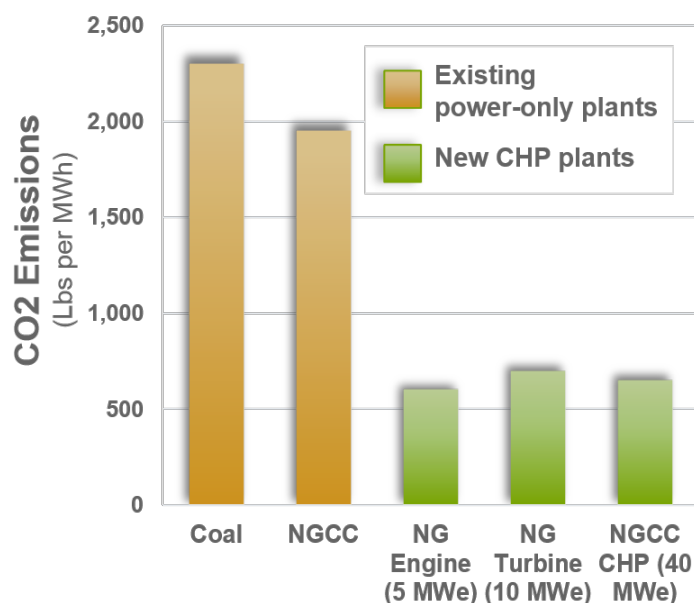


Fig. 1: Comparison of carbon dioxide emissions from power-only and CHP plants. (Source: FVB Energy)



Standby rate design elements

For customers with onsite generation, many utilities offer standby rates to recover costs for providing:

- Backup power during unplanned outages
- Maintenance power during planned outages
- Economic replacement power when it costs less than onsite generation
- Supplemental power for customer needs beyond those met by onsite systems

Standby rates include structural components to serve specific customer use cases, varying from customers whose onsite power systems generally meet their full requirements, to those that rely regularly on supplemental utility service.

Standby Rate Elements

The following design elements are most common among standby rates for full-requirement customers – i.e., those with onsite generation capacity sufficient to meet their full requirements:

Customer charges: Monthly or daily fixed charges attributed to the costs of metering, service drop, etc., for a given customer. This grid-access fee is assessed irrespective of whether and how much standby power is used.

Energy charges: Cover the customer's actual consumption of electricity, usually on a per-kWh basis. Utilities can differentiate these rates according to time of use, season, or block of consumption.

Demand charges: Recover capital costs of making utility capacity available to meet the customer's peak load (generally for larger commercial and industrial customers). Utilities assess demand charges as a means of recovering fixed system costs.

Service Features and Fees

Standby rates often include additional features to set rates for specific services, encourage reliability, and reward efficient use of standby service. Examples:

Reservation charges: Monthly fees for reserving standby capacity, irrespective of whether standby service is used in a given month.

Demand ratchet: Set a customer's bill on the basis of usage for the prior year or season. Sometimes used to set demand charges for onsite power customers.

Grace period: Allotted time during which a standby customer may use backup service without incurring additional demand or usage charges.

Forced outage rate: The number of hours during a given period that a generating unit is forced out of service for emergency reasons, divided by the total number of planned available hours.

Coincident factor: The ratio of a customer's standby power demand coinciding with utility on-peak and off-peak demand periods. A customer with a higher coincident factor will require more standby service during utility peak-demand periods, imposing higher costs per kW of demand than a customer with a lower coincident factor.

Standby rates offered by Minnesota's regulated utilities generally include:

- Monthly customer charges (\$/month)
- Reservation charges (\$/kW)
- Usage charges (\$/kW and \$/kWh)

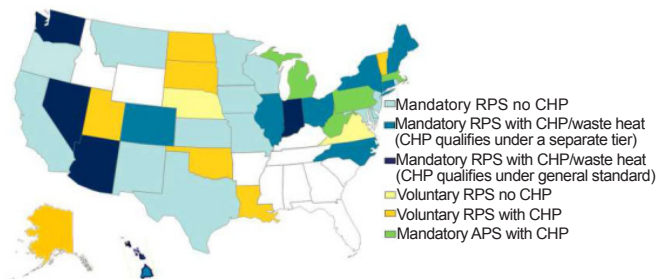


CHP and state portfolio standards

Numerous states have implemented policies intended to facilitate deployment of combined heat and power (CHP) systems. These policies generally take three forms:

- Renewable portfolio standards (RPS)
- Energy efficiency resource standards (EERS)
- Alternative portfolio standards (APS)

Among the 42 states (plus the District of Columbia) where clean energy standards are in place, 24 include CHP or waste-heat-to-power (WHP) as eligible resources.



States with Portfolio Standards and how CHP qualifies (under RPS or APS)

Renewable Portfolio Standards

Some states include CHP or WHP in RPS programs. CHP using biofuels qualifies in most state RPS programs, and several states (including CO, CT, HI, ME, NV and NC) either provide a separate tier for CHP, or they allow CHP to qualify under general standards, with some restrictions.

Energy Efficiency Resource Standards

Under EERS policies, utilities are expected to meet annual targets for reducing energy consumption. Programs provide financial incentives for investment in energy efficiency measures. Several states (MA, OH, IL and MD) allow CHP to qualify under EERS policies.

Alternative Portfolio Standards

Alternative energy portfolio standards (APS) are similar to RPS policies, with special provisions for non-renewable clean energy sources such as CHP. Like an RPS, an APS sets targets for

utilities to procure a percentage of energy supply from alternative energy sources. The Commonwealth of Massachusetts includes CHP as an eligible resource in both its EERS and APS programs.

Qualifying CHP in Energy Standards

Whether and how CHP may be used to meet RPS, EERS, and APS goals varies among the different state programs. Some programs allow only bottoming-cycle systems (generally WHP), while others allow CHP only if it uses renewable fuels. Some states (*i.e.*, MA and CT) explicitly allow CHP using any fuel to meet state standards.

Minimum Efficiency and Performance

To qualify for state energy portfolio standards, CHP generally is required to meet minimum efficiency requirements or performance metrics. Efficiency standards in some states (*i.e.*, CT, OH, and WA) establish thresholds to ensure CHP achieves substantial energy savings compared to separate heat and power, while state performance metrics (*i.e.*, MA) provide more incentives for projects that achieve greater benefits for the same unit of cost.

CHP Tiers and Targets

Some states establish specific goals for CHP and related technologies. Such approaches include a separate tier for CHP within an RPS program (CT and PA) and separate targets in APS or EERS programs (MA and MI).



End of Appendices

Final Report – Combined Heat and Power Stakeholder Engagement Process:
Options, Outcomes, and Recommendations

February 2015

